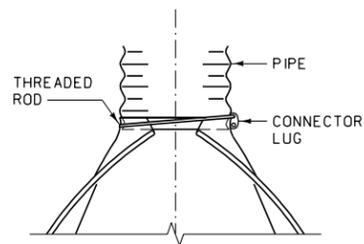


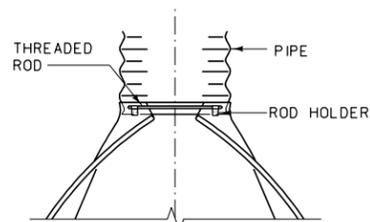
CONNECTIONS

ARCH PIPE

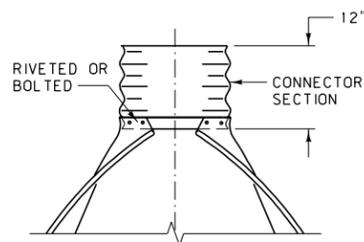
ROUND PIPE



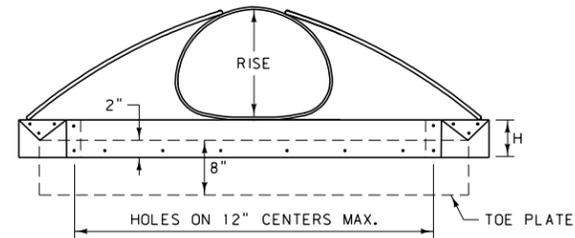
TYPE 1



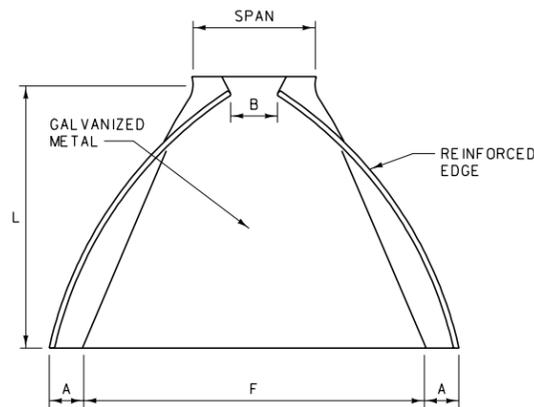
TYPE 2



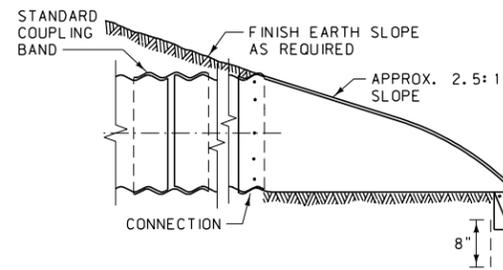
TYPE 3



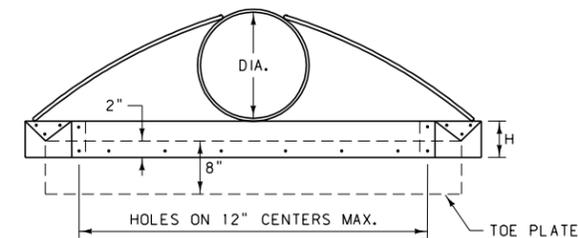
ELEVATION



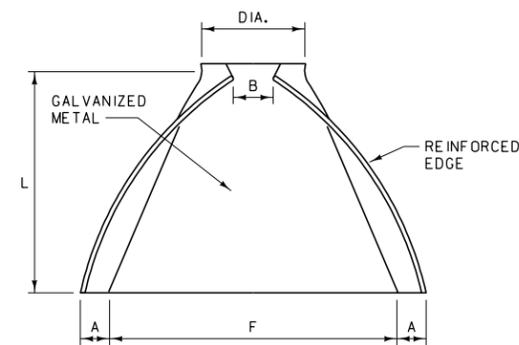
PLAN



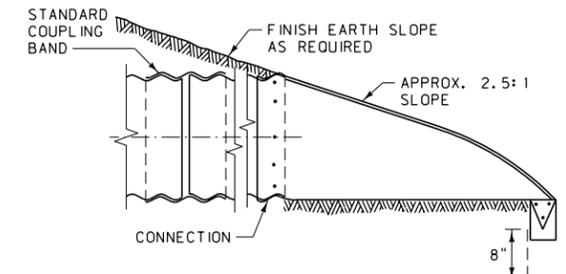
TYPICAL CROSS-SECTION  
(ILLUSTRATED WITH TYPE 3 CONNECTION)



ELEVATION



PLAN



TYPICAL CROSS-SECTION  
(ILLUSTRATED WITH TYPE 3 CONNECTION)

NOTES:

PROVIDE TOE PLATE WHEN SPECIFIED.

GALVANIZE ALL PARTS IN ACCORDANCE WITH AASHTO M 36.

PAINT ANY AREAS WHERE GALVANIZING IS BROKEN OR METAL IS BARE WITH ONE COAT OF ZINC CHROMATE PRIME AND TWO COATS OF ALUMINUM PAINT.

MINOR VARIATIONS IN DESIGN MAY BE ACCEPTABLE ON APPROVAL OF THE ENGINEER.

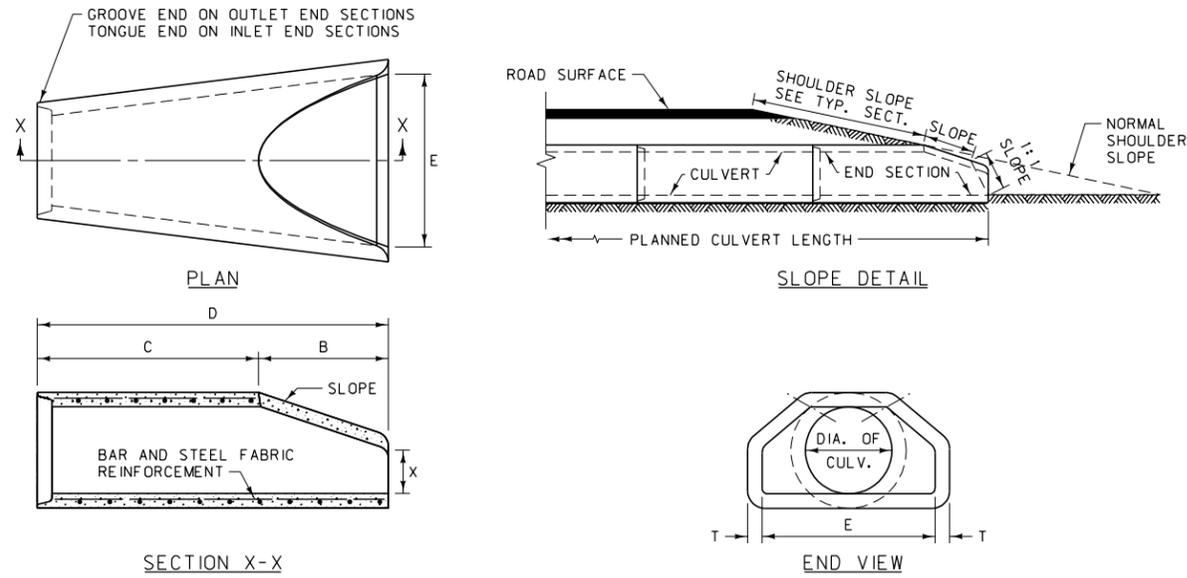
SEAMS OR JOINTS LENGTHWISE OF THE APRON ARE ACCEPTABLE IF SECURELY BOLTED OR WELDED AND PAINTED AS PROVIDED ABOVE.

3" x 1" CORR. SPAN x RISE	MINIMUM THICKNESS	2 2/3" x 1/2" CORR. SPAN x RISE	MINIMUM THICKNESS	DIMENSIONS					TYPE CONNECTOR
				A 1" TOL.	B MAX.	H 1" TOL.	L 1 1/2" TOL.	F 2" TOL.	
		17" x 13"	0.064"	7"	9"	6"	19"	30"	2
		21" x 15"	0.064"	7"	10"	6"	23"	30"	2
		24" x 18"	0.064"	8"	12"	6"	28"	42"	2
		28" x 20"	0.064"	9"	14"	6"	32"	48"	2
		35" x 24"	0.079"	10"	16"	6"	39"	60"	2
40" x 31"	0.079"	42" x 29"	0.079"	12"	18"	8"	46"	75"	3
46" x 36"	0.109"	49" x 33"	0.109"	13"	21"	9"	53"	85"	3
53" x 41"	0.109"	57" x 38"	0.109"	18"	26"	12"	63"	90"	3
60" x 46"	0.109"	64" x 43"	0.109"	18"	30"	12"	70"	102"	3
66" x 51"	0.109"	71" x 47"	0.109"	18"	33"	12"	77"	114"	3
73" x 55"	0.109"	77" x 52"	0.109"	18"	36"	12"	77"	126"	3
81" x 59"	0.109"	83" x 57"	0.109"	18"	36"	12"	77"	138"	3

PIPE DIA.	MINIMUM THICKNESS	DIMENSIONS					TYPE CONNECTOR
		A 1" TOL.	B MAX.	H 1" TOL.	L 1 1/2" TOL.	F 2" TOL.	
12"	0.064"	6"	6"	6"	21"	24"	1
15"	0.064"	7"	8"	6"	26"	30"	1
18"	0.064"	8"	10"	6"	31"	36"	1
21"	0.064"	9"	12"	6"	36"	42"	1
24"	0.064"	10"	13"	6"	41"	48"	1
30"	0.079"	12"	16"	8"	51"	60"	2
36"	0.079"	14"	19"	9"	60"	72"	2
42"	0.109"	16"	22"	11"	69"	84"	3
48"	0.109"	18"	27"	12"	78"	90"	3
54"	0.109"	18"	30"	12"	84"	102"	3
60"	0.109"	18"	33"	12"	87"	114"	3
66"	0.109"	18"	36"	12"	87"	120"	3
72"	0.109"	18"	39"	12"	87"	126"	3
78"	0.109"	18"	42"	12"	87"	132"	3
84"	0.109"	18"	45"	12"	87"	138"	3

DETAILED DRAWING  
 REFERENCE DWG. NO.  
 STANDARD SPEC. 603-02  
 SECTION 603, 709  
 CMP FLARED END  
 TERMINAL SECTION  
 (FETS)  
 EFFECTIVE: FEBRUARY 2005  
 MONTANA DEPARTMENT  
 OF TRANSPORTATION

TYPE "A"

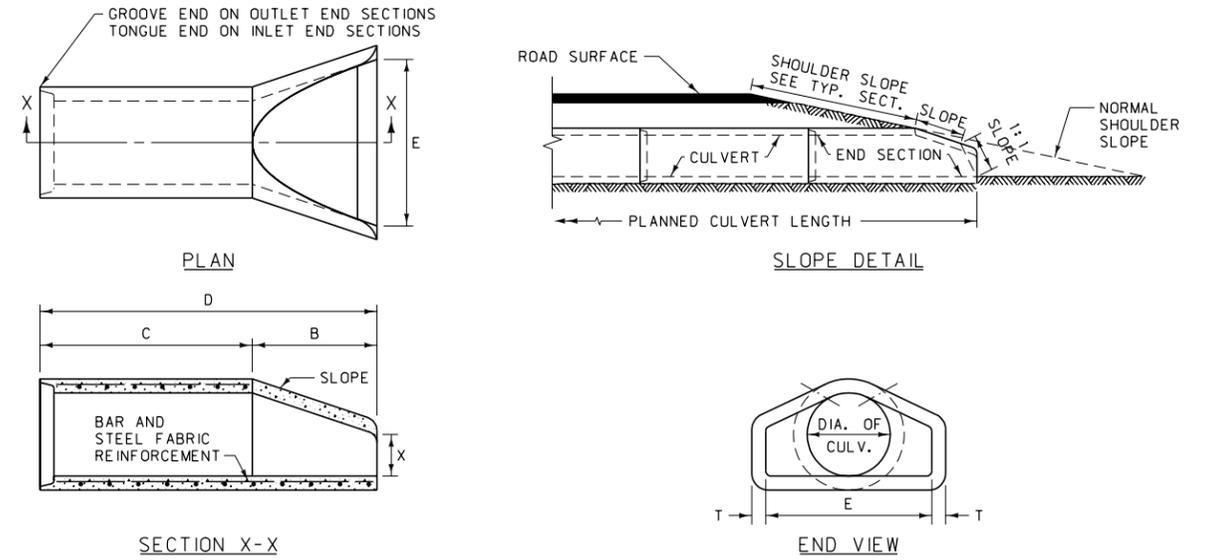


TYPE "A"							
DIA.	SLOPE	X	B	C	D	E	T *
12"	2.4:1	4"	2'-0"	4'-0"	6'-0"	2'-0"	2"
15"	2.4:1	6"	2'-3"	3'-9"	6'-0"	2'-6"	2 1/4"
18"	2.3:1	9"	2'-3"	3'-9"	6'-0"	3'-0"	2 1/2"
24"	2.5:1	9 1/2"	3'-7 1/2"	2'-4 1/2"	6'-0"	4'-0"	3"
30"	2.5:1	1'-0"	4'-6"	1'-6"	6'-0"	5'-0"	3 1/2"
36"	2.5:1	1'-3"	5'-3"	2'-11"	8'-2"	6'-0"	4"
42"	2.5:1	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"	4 1/2"
48"	2.5:1	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"	5"
54"	2.0:1	2'-3"	5'-5"	2'-9 1/2"	8'-2 1/2"	7'-6"	5 1/2"

\* WALL "B" THICKNESS

TOLERANCES IN THE ADJACENT TABLES MAY NOT VARY MORE THAN ±1.5% FOR THE DIMENSIONS SHOWN. OTHERWISE THEY MUST CONFORM TO AASHTO M 170.

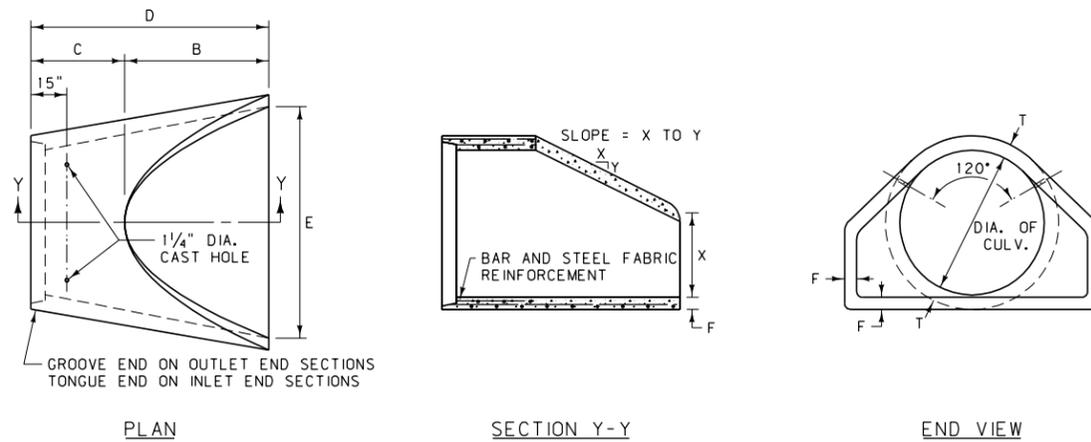
TYPE "B"



TYPE "B"							
DIA.	SLOPE	X	B	C	D	E	T *
12"	2.4:1	4"	2'-0"	4'-0"	6'-0"	2'-0"	2"
15"	2.4:1	6"	2'-3"	3'-9"	6'-0"	2'-6"	2 1/4"
18"	2.3:1	9"	2'-3"	3'-9"	6'-0"	3'-0"	2 1/2"
24"	2.5:1	9 1/2"	3'-7 1/2"	2'-4 1/2"	6'-0"	4'-0"	3"
30"	2.5:1	1'-0"	4'-6"	1'-6"	6'-0"	5'-0"	3 1/2"
36"	2.5:1	1'-3"	5'-3"	2'-11"	8'-2"	6'-0"	4"
42"	2.5:1	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"	4 1/2"
48"	2.5:1	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"	5"
54"	2.0:1	2'-3"	5'-5"	2'-9 1/2"	8'-2 1/2"	7'-6"	5 1/2"

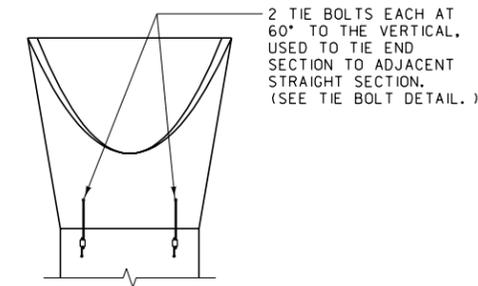
\* WALL "B" THICKNESS

LARGE DIAMETER PIPE



LARGE DIAMETER CULVERT								
DIA.	SLOPE	T *	X	B	C	D	E	F
60"	1.9:1	6"	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"	5"
66"	1.7:1	6 1/2"	2'-6"	6'-0"	2'-3"	8'-3"	8'-6"	5 1/2"
72"	1.9:1	7"	3'-0"	6'-6"	1'-9"	8'-3"	9'-0"	6"
78"	1.8:1	7 1/2"	3'-0"	7'-6"	1'-9"	9'-3"	9'-6"	6 1/2"
84"	1.5:1	8"	3'-0"	7'-6 1/2"	1'-9"	9'-3 1/2"	10'-0"	6 1/2"
90"	1.5:1	8 1/2"	3'-5"	7'-3 1/2"	2'-0"	9'-3 1/2"	11'-0"	6 1/2"

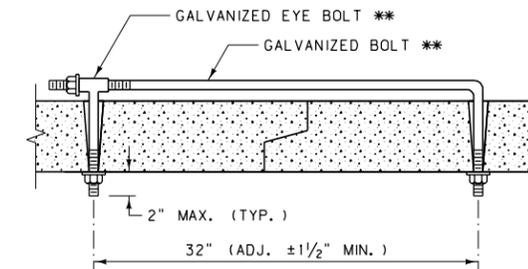
\* WALL "B" THICKNESS



TIE BOLT CONNECTION

TIE BOLTS: USE TWO TIE BOLTS ON ALL FLARED END SECTIONS, ONE ON EACH SIDE AT 60° TO THE VERTICAL. GALVANIZE ALL PARTS. SEE TIE BOLT DETAIL.

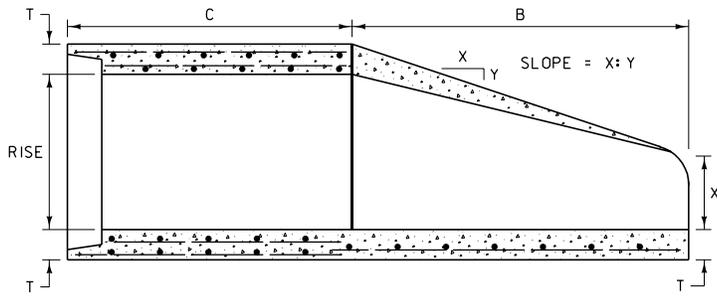
CONSTRUCTION: CONSTRUCT ACCORDING TO CLASS III, AASHTO M 170, AS FAR AS DESIGN WILL PERMIT.



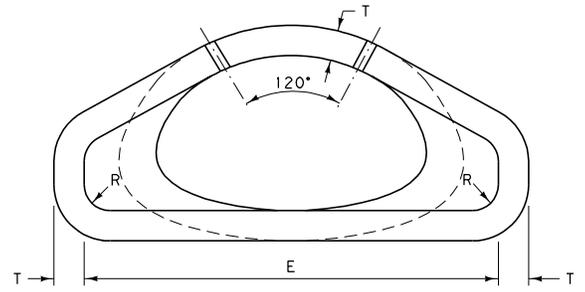
TIE BOLT DETAIL (TWO PER END SECTION)

\*\* 3/4" FOR 12" TO 54" DIA. RCP  
1" FOR 60" TO 84" DIA. RCP

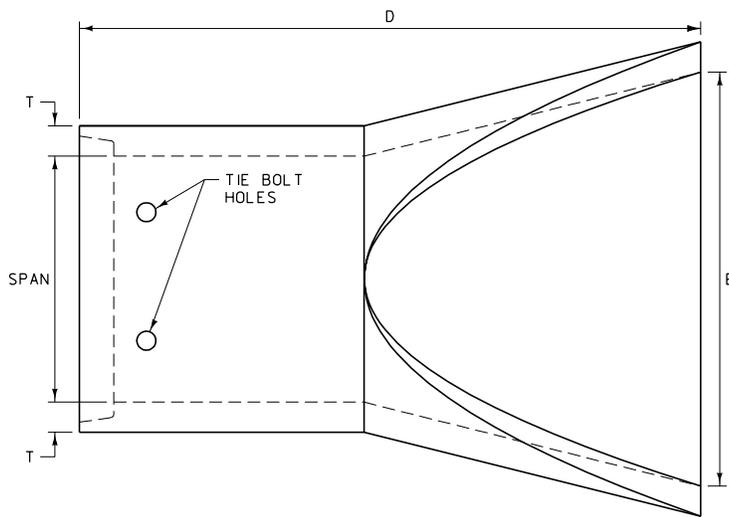
DETAILED DRAWING  
 REFERENCE DWG. NO.  
 STANDARD SPEC. 603-08  
 SECTION 603, 708  
 PREFABRICATED RCP  
 FLARED END TERMINAL  
 SECTION (FETS)  
 EFFECTIVE: FEBRUARY 2005  
 MONTANA DEPARTMENT OF TRANSPORTATION  
 serving you with pride



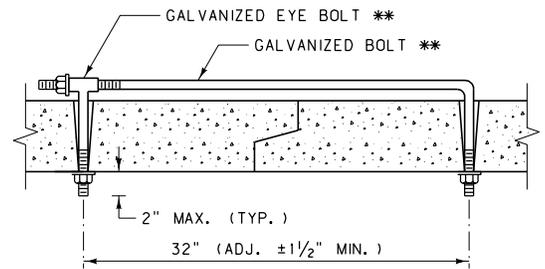
LONGITUDINAL SECTION



END VIEW



PLAN VIEW



\*\* 3/4" FOR 18" TO 54" EQUIV. SIZE  
1" FOR 60" TO 72" EQUIV. SIZE

TIE BOLT DETAIL  
(TWO PER END SECTION)

TIE BOLTS: USE TIE BOLTS ON ALL FLARED END SECTIONS, ONE ON EACH SIDE AT 60° TO THE VERTICAL. GALVANIZE ALL PARTS. SEE TIE BOLT DETAIL.

CONSTRUCTION: CONSTRUCT ACCORDING TO CLASS A-III, AASHTO M 206, AS FAR AS DESIGN WILL PERMIT.

EQUIV. SIZE	SPAN	RISE	T *	X	B	C	D	E	R	SLOPE
18"	22"	13 1/2"	2 1/2"	7"	27"	45"	72"	36"	3"	3:1
24"	28 1/2"	18"	3 1/2"	8 1/2"	39"	33"	72"	48"	3"	3:1
30"	36 1/4"	22 1/2"	4"	9 1/2"	50"	46"	96"	60"	3"	3:1
36"	43 3/4"	26 5/8"	4 1/2"	11 1/8"	60"	36"	96"	72"	6"	3:1
42"	51 1/8"	31 5/16"	4 1/2"	15 13/16"	60"	36"	96"	78"	6"	3:1
48"	58 1/2"	36"	5"	21"	60"	36"	96"	84"	6"	3:1
54"	65"	40"	5 1/2"	25 1/2"	60"	36"	96"	90"	6"	3:1
60"	73"	45"	6"	31"	60"	36"	96"	96"	6"	3:1
72"	88"	54"	7"	31"	60"	36"	96"	120"	6"	2:1
84"	102"	62"	8"	21 1/2"	84"	24"	108"	144"	6"	2:1

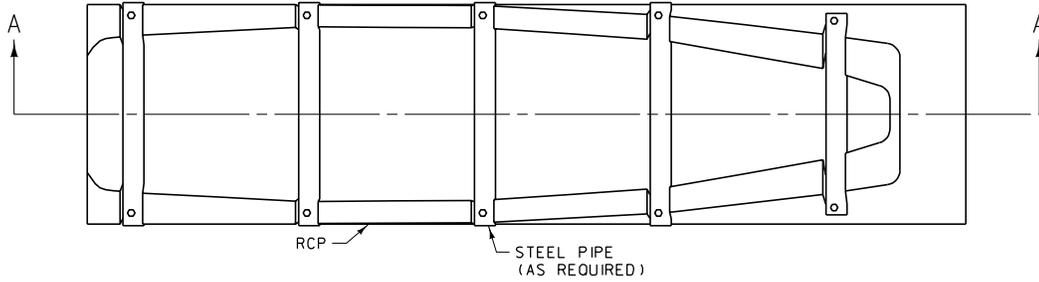
\* WALL "B" THICKNESS

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603	DWG. NO. 603-10
PREFABRICATED RCP ARCH FLARED END TERMINAL SECTION (FETS)	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION	servicing you with pride

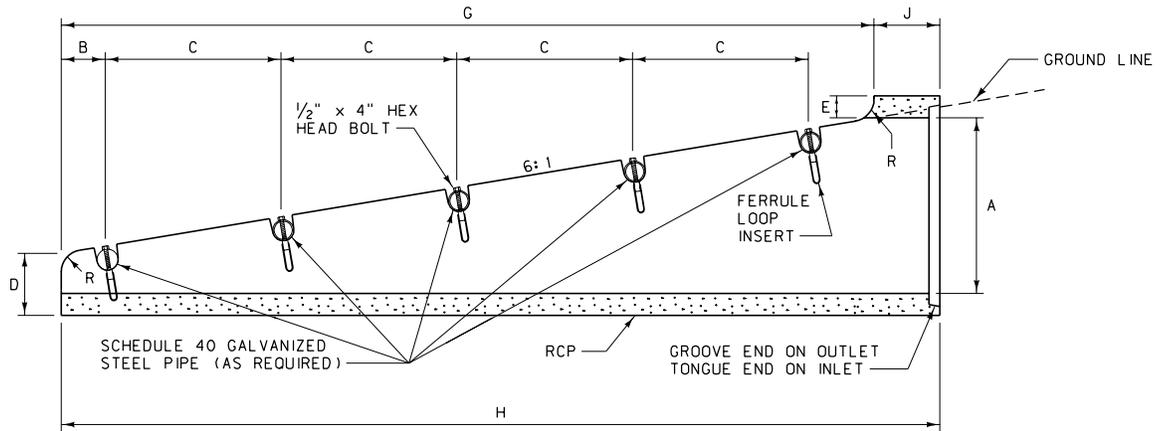
# ROAD APPROACH CULVERT END TREATMENT

QUANTITIES (FOR ESTIMATING ONLY)

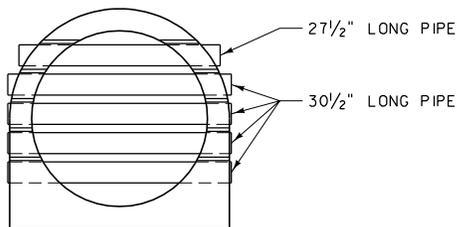
DIA. A RCP	H PIPE LENGTH	F-64½" x 4⅞" FERRULE LOOP INSERT (EACH)	LENGTH 2½" DIA. SCHEDULE 40 GALV. PIPE	DIMENSIONS (FT.)						
				B	C	D	E	G	R	J
15"	4.75'	~	~	~	~	0.69	0.27	4.0	0.25	0.75
18"	6.5'	~	~	~	~	0.71	0.25	5.75	0.25	0.75
24"	10.0'	10	12.5'	0.5	2.0	0.75	0.21	9.25	0.25	0.75



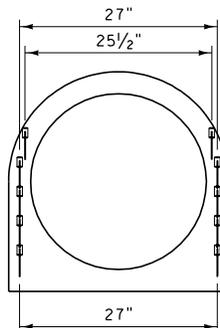
PLAN VIEW



SECTION A-A



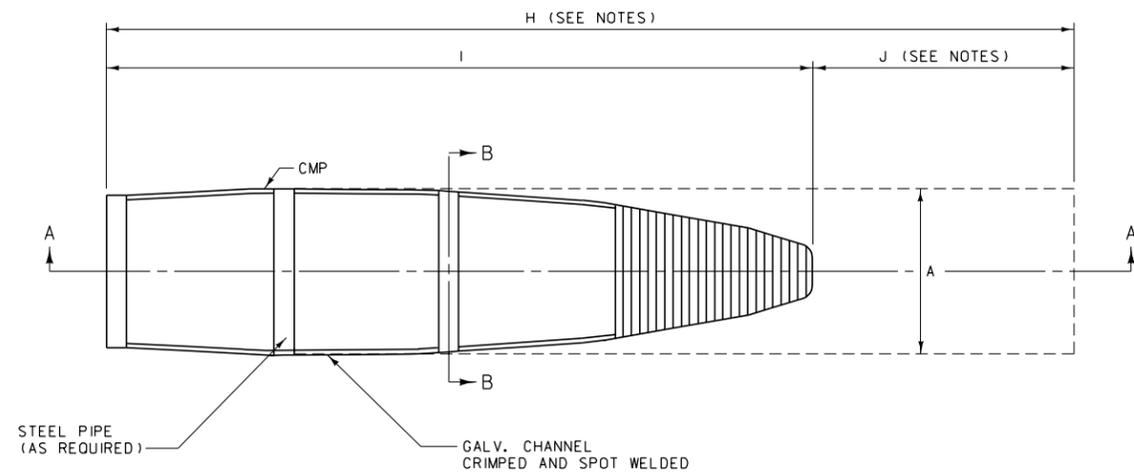
END VIEW



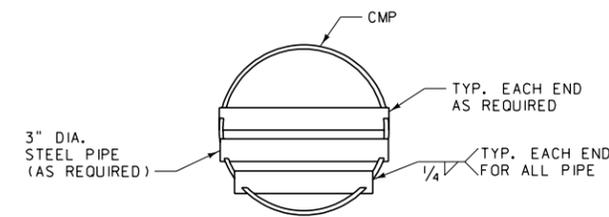
VIEW OF INSERTS

NOTE:  
PAINT ALL NON-GALVANIZED PARTS  
IN ACCORDANCE WITH SECTION 710  
OF THE STANDARD SPECIFICATIONS.

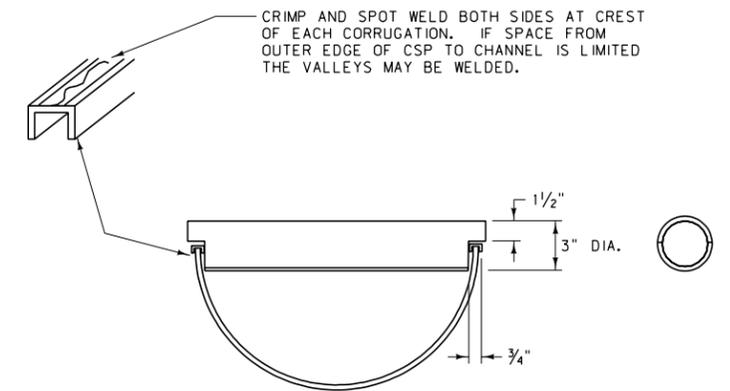
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603, 710	DWG. NO. 603-12
RCP ROAD APPROACH CULVERT END TREATMENT (RACET)	
EFFECTIVE: FEBRUARY 2005	
<span style="font-weight: bold; font-size: small;">MONTANA DEPARTMENT OF TRANSPORTATION</span> <small>servicing you with pride</small>	



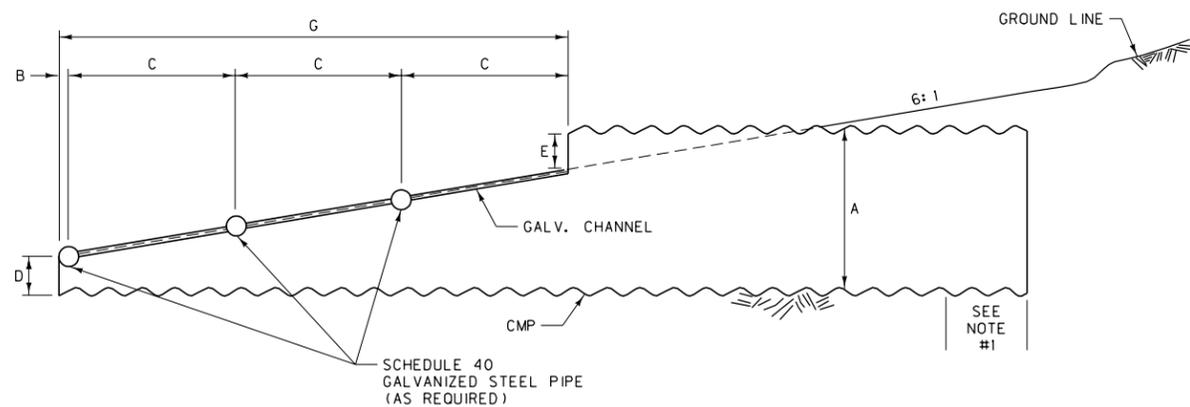
PLAN VIEW



END VIEW



SECTION B-B



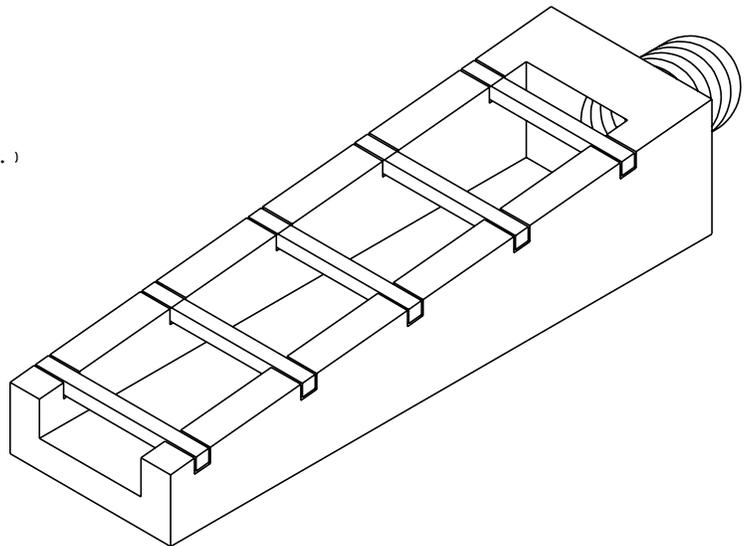
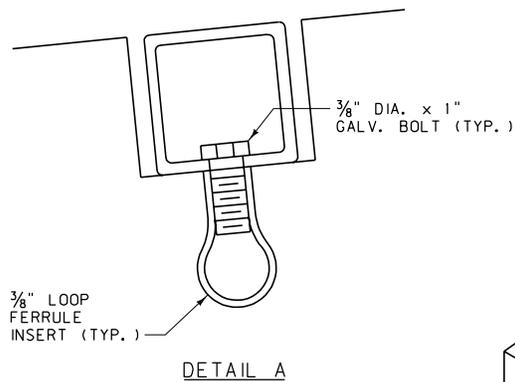
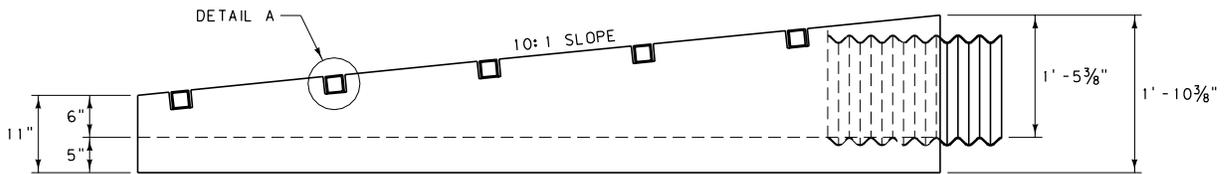
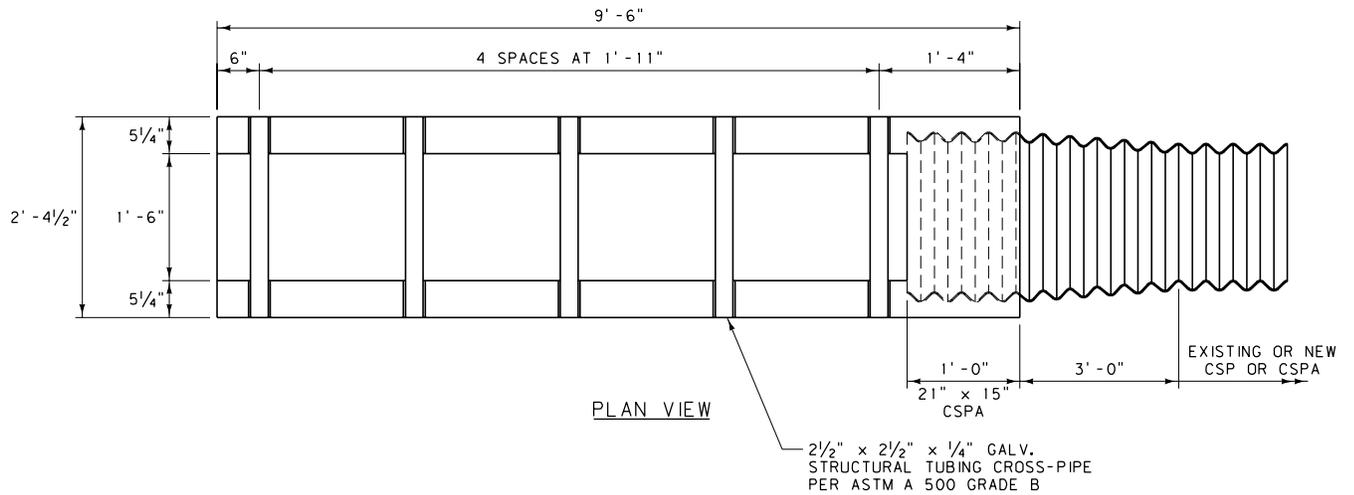
SECTION A-A  
ILLUSTRATED WITH 24" CMP (30" CMP UTILIZES FOUR GALV. STEEL PIPES)

ROAD APPROACH CULVERT END TREATMENT										
QUANTITIES (FOR ESTIMATING ONLY)										
DIA. A CMP	H PIPE LENGTH	3/4" x 3/8" x 1/8" GALV. CHANNEL	LENGTH 3" DIA SCHEDULE 40 GALV. PIPE	DIMENSIONS (FT.)						
				B	C	D	E	G	I	J
15"	7.0'	10'	~	~	~	0.20	0.20	5.0	6.0	1.0
18"	8.0'	10'	~	~	~	0.33	0.33	5.0	7.0	1.0
24"	10.0'	12'	6.0'	0.15	1.95	0.50	0.50	6.0	9.0	1.0
30"	12.5'	16'	10.0'	0.20	1.95	0.60	0.60	8.0	11.5	1.0

NOTES:

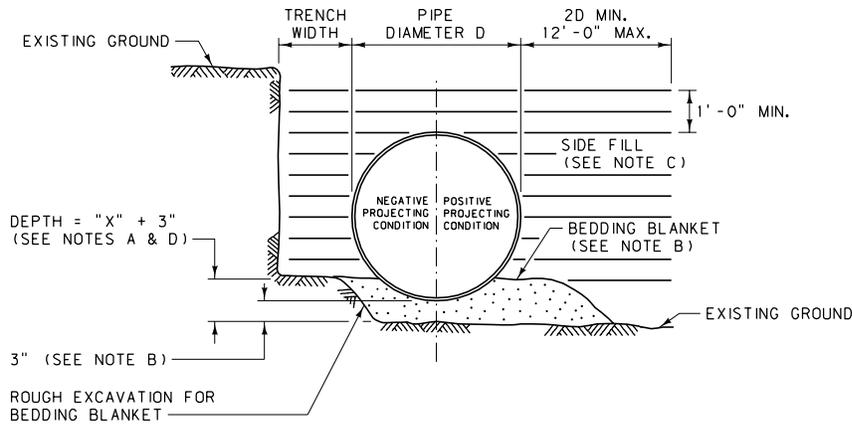
- PIPE TO HAVE ANNULAR CORRUGATION OR REROLLED ENDS. USE ONLY APPROVED COUPLING BAND PER STANDARD SPECIFICATION 709.02 CMP. FOR RCP END TREATMENT, SEE DTL. DWG. NO. 603-26 FOR CONNECTION.
- THE TWO 3/4" CHANNELS MAY BE ELIMINATED FROM THE CULVERT END TREATMENT IF:
  - THE CULVERT IS FABRICATED WITH 12 GAGE (0.109" THICK) MATERIAL.
  - HALF CIRCLE NOTCHES ARE CUT IN THE CULVERT FOR THE STEEL PIPE WITH CONTINUOUS WELD OF THE PERIPHERY IN CONTACT PROVIDED.
  - ALL WELDS AND OTHER NON-GALVANIZED PARTS ARE PAINTED IN ACCORDANCE WITH STANDARD SPECIFICATIONS SECTION 710.
- CONNECTIONS MADE PER DTL. DWG. NO. 603-26 REQUIRE PIPE LENGTHS H AND J TO BE INCREASED BY 3".

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603, 709, 710	DWG. NO. 603-14
CMP ROAD APPROACH CULVERT END TREATMENT (RACET)	
EFFECTIVE: FEBRUARY 2005	
 serving you with pride	MONTANA DEPARTMENT OF TRANSPORTATION



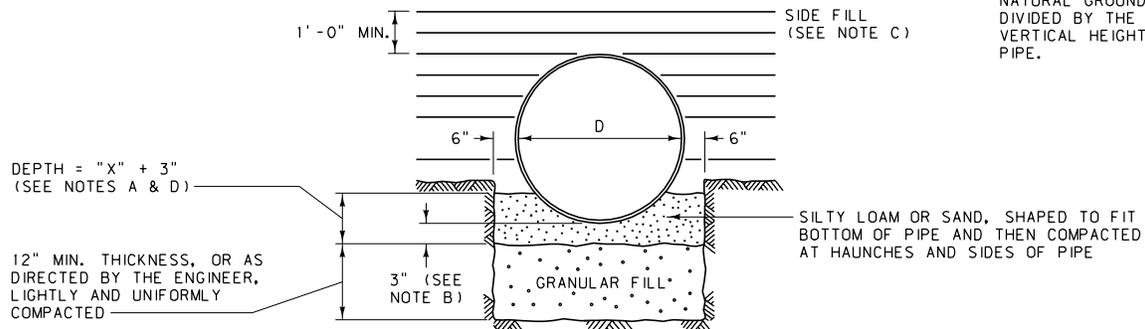
NOTE:  
 PAINT ALL EXPOSED METAL PARTS WITH ONE COAT OF ZINC RICH PAINT AND TWO COATS OF ALUMINUM PAINT ACCORDING TO STANDARD SPECIFICATION SECTION 710.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603, 708, 710	DWG. NO. 603-17
PRECAST MEDIAN U-TURN CROSS DRAIN AND CONC. BEVELED END	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION <i>servicing you with pride</i>	

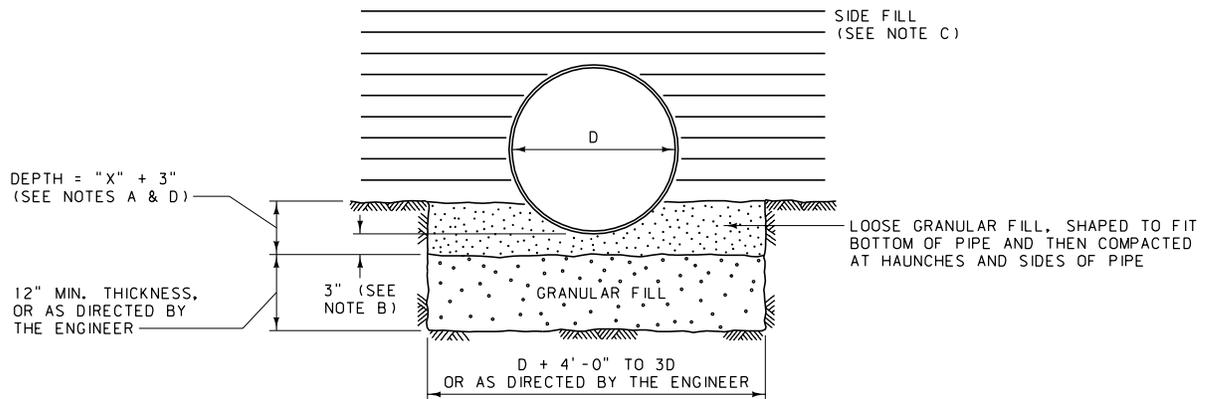


1- PIPE INSTALLATION AND BEDDING  
(CLASS C, MODIFIED)

NOTE: THE PROJECTION RATIO FOR POSITIVE EMBANKMENT INSTALLATIONS EQUALS THE VERTICAL DISTANCE BETWEEN THE TOP OF THE PIPE AND THE NATURAL GROUND SURFACE DIVIDED BY THE OUTSIDE VERTICAL HEIGHT OF THE PIPE.



2-ROCK



3-FOUNDATION STABILIZATION

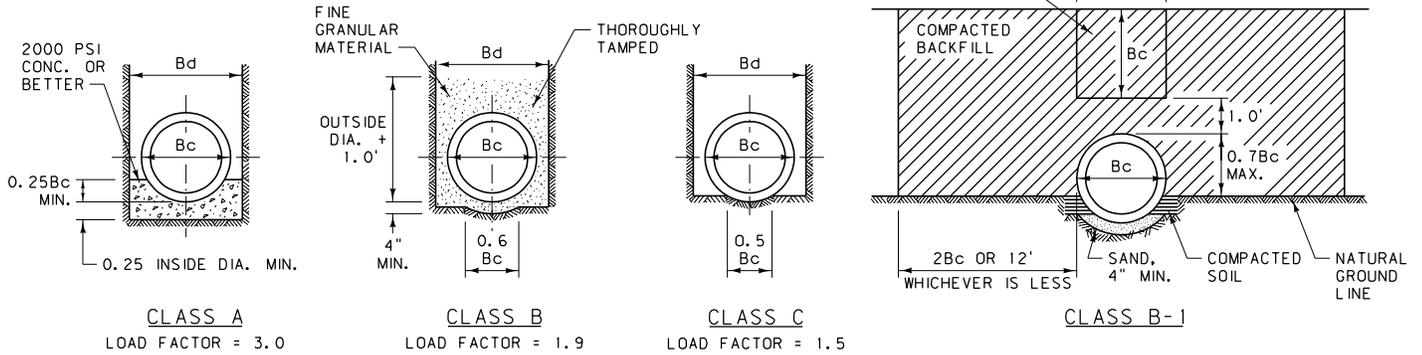
NOTES:

- (A) FOR STRUCTURAL PLATE PIPE, THE LENGTH OF BEDDING ARC NEED NOT EXCEED WIDTH OF BOTTOM PLATE.
- (B) SHAPE BEDDING BLANKET OF SILTY LOAM OR SAND TO FIT BOTTOM OF PIPE. THE MINIMUM THICKNESS BEFORE PLACING PIPE IS 3".
- (C) COMPACT SIDE FILL IN 6" LAYERS TO DENSITY SPECIFIED FOR ADJACENT EMBANKMENT. SEE SECTION 203.03.3 OF THE STANDARD SPECIFICATIONS FOR THE DENSITY REQUIREMENTS.
- (D) SEE DTL. DWG. NO. 603-32 AND 603-34 FOR "X" DIMENSIONS.

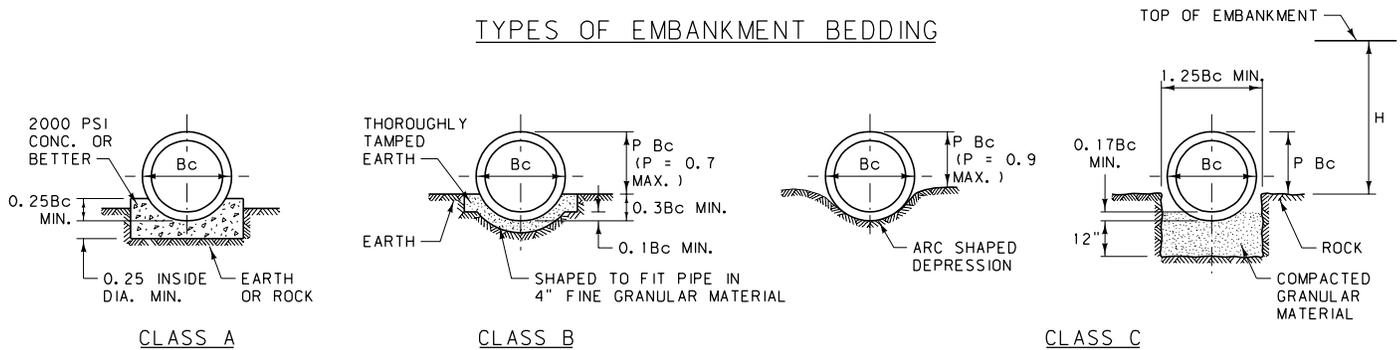
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 207, 603, 701	DWG. NO. 603-18
CSP AND SSPP CULVERT BEDDING	
EFFECTIVE: FEBRUARY 2005	
 <b>MONTANA DEPARTMENT OF TRANSPORTATION</b> <i>servicing you with pride</i>	

## TYPES OF TRENCH BEDDING

NOTE: THE PROJECTION RATIO (P) FOR POSITIVE EMBANKMENT INSTALLATIONS EQUALS THE VERTICAL DISTANCE BETWEEN THE TOP OF THE PIPE AND THE NATURAL GROUND SURFACE DIVIDED BY THE OUTSIDE VERTICAL HEIGHT OF THE PIPE.



## TYPES OF EMBANKMENT BEDDING



## DESCRIPTION OF BEDDING CLASSES

### CLASS A CONCRETE CRADLE BEDDING

THE LOWER PART OF THE PIPE EXTERIOR IS BEDDED IN A CONTINUOUS CRADLE CONSTRUCTED OF 2000 PSI CONCRETE OR BETTER, HAVING A MINIMUM THICKNESS UNDER THE PIPE OF ONE-FOURTH THE NOMINAL INSIDE DIAMETER AND EXTENDING UP THE SIDES OF THE PIPE FOR A HEIGHT EQUAL TO ONE-FOURTH OF THE OUTSIDE DIAMETER. THE CRADLE HAS A MINIMUM WIDTH EQUAL TO THE OUTSIDE DIAMETER OF THE PIPE PLUS 8", AND IS CONSTRUCTED MONOLITHICALLY WITHOUT HORIZONTAL CONSTRUCTION JOINTS.

### CLASS B BEDDING

(1) THIS CLASS OF BEDDING FOR EMBANKMENT CONDITIONS IS APPLICABLE ONLY WHEN THE PROJECTION RATIO IS 0.7 AND LESS. THE PIPE IS BEDDED CAREFULLY ON FINE GRANULAR MATERIALS OVER AN EARTH FOUNDATION, ACCURATELY SHAPED BY MEANS OF A TEMPLATE TO FIT THE LOWER PART OF THE PIPE EXTERIOR FOR AT LEAST 10% OF THE CULVERT OVERALL HEIGHT. THEN COMPACTABLE SOIL MATERIAL IS RAMMED AND TAMPED IN LAYERS NOT MORE THAN 6" THICK AROUND THE PIPE FOR THE REMAINDER OF THE LOWER 20% OF ITS HEIGHT. BACKFILLING IS COMPLETED TO THE TOP OF THE PIPE, CONFORMING WITH THE APPLICABLE PROVISIONS OF THE STANDARD SPECIFICATIONS.

(2) FOR TRENCH CONDITIONS, THE CULVERT IS PLACED AS DESCRIBED IN B(1) EXCEPT THAT THE EARTH FOUNDATION IS SHAPED TO FIT THE LOWER PART OF THE CULVERT EXTERIOR FOR A WIDTH OF AT LEAST 60% OF THE CULVERT BREADTH. THEN THE REMAINDER OF THE CULVERT IS ENTIRELY SURROUNDED TO A HEIGHT OF AT LEAST 12" ABOVE ITS TOP WITH GRANULAR MATERIAL PLACED BY HAND TO FILL ALL SPACES UNDER AND ADJACENT TO THE CULVERT. THE FILL IS TAMPED THOROUGHLY ON EACH SIDE AND UNDER THE CULVERT AS FAR AS PRACTICAL IN LAYERS NOT TO EXCEED 6" IN THICKNESS.

### CLASS B-1 BEDDING

IN THIS TYPE OF INSTALLATION, SOMETIMES CALLED THE IMPERFECT TRENCH METHOD, THE PIPE CULVERT IS FIRST INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF B(2). THEN THE FILL IS COMPACTED AT EACH SIDE OF THE PIPE FOR A LATERAL DISTANCE EQUAL TO TWICE THE OUTSIDE DIAMETER OR 12 FEET, WHICHEVER IS LESS, AND CARRIED UP TO AN ELEVATION ABOVE THE TOP OF THE PIPE EQUAL TO THE OUTSIDE DIAMETER OF THE PIPE PLUS 12". NEXT A TRENCH IS DUG EQUAL IN WIDTH TO THE OUTSIDE DIAMETER OF THE PIPE IN THE FILL DIRECTLY OVER THE CULVERT, DOWN TO AN ELEVATION 12" ABOVE THE TOP OF THE PIPE. CARE IS EXERCISED TO KEEP THE SIDES AS VERTICAL AS POSSIBLE. AFTER THE TRENCH IS EXCAVATED, IT IS REFILLED WITH LOOSE, HIGHLY COMPRESSIBLE SOIL MATERIAL. STRAW, HAY, LEAVES, BRUSH OR SAWDUST MAY BE USED TO FILL THE LOWER ONE-FOURTH TO ONE-THIRD OF THE TRENCH IN ORDER TO INSURE HIGH COMPRESSIBILITY OF THE BACKFILL. THIS BACKFILL OF STRAW, HAY, ETC. MAY NOT BE CARRIED CLOSER THAN 10 FEET TO THE OUTSIDE SLOPE OF THE FILL; THE OUTSIDE 10 FEET IS COMPOSED OF IMPERVIOUS MATERIAL, THOROUGHLY COMPACTED. AFTER THE BACKFILL IS COMPLETED, THE BALANCE OF THE FILL IS CONSTRUCTED BY NORMAL METHODS UP TO THE FINISHED GRADE OF EMBANKMENT.

### CLASS C BEDDING

FOR PROJECTING EMBANKMENT CULVERTS, THIS METHOD OF BEDDING IS WITH "ORDINARY" CARE IN AN EARTH FOUNDATION SHAPED IN THE FORM OF AN ARC TO FIT THE LOWER PART OF THE CULVERT EXTERIOR WITH REASONABLE CLOSENESS FOR AT LEAST 10% OF ITS OVERALL HEIGHT. THE REMAINDER OF PIPE IS SURROUNDED BY MATERIAL PLACED BY HAND TOOLS TO COMPLETELY FILL ALL SPACES UNDER AND ADJACENT TO THE PIPE. THEN BACKFILLING IS COMPLETED TO THE TOP AS SPECIFIED IN THE

STANDARD SPECIFICATIONS. IF THE CULVERT IS PLACED ON ROCK FOUNDATIONS, PROJECTING EMBANKMENT CULVERT PIPES ARE BEDDED ON AN EARTH CUSHION HAVING A MINIMUM ALLOWABLE THICKNESS OF 12" ± WITH THE EARTH FOUNDATION CAREFULLY SHAPED AND FILLED AROUND THE CULVERT THE SAME AS ORDINARY PROJECTING EMBANKMENT BEDDING ON AN EARTH FOUNDATION.

### CLASS C-1 BEDDING

THE PIPE IS INSTALLED IN ACCORDANCE WITH CLASS C BEDDING, USING THE IMPERFECT TRENCH METHOD AS DESCRIBED UNDER CLASS B-1 BEDDING.

WHEN NATURAL GROUND MATERIAL SIMULATES BEDDING MATERIAL, NO SPECIAL BEDDING MATERIAL NEED BE USED. CLASS C BEDDING IS USED UNLESS OTHERWISE NOTED ON THE PLANS.

### COMPACTION

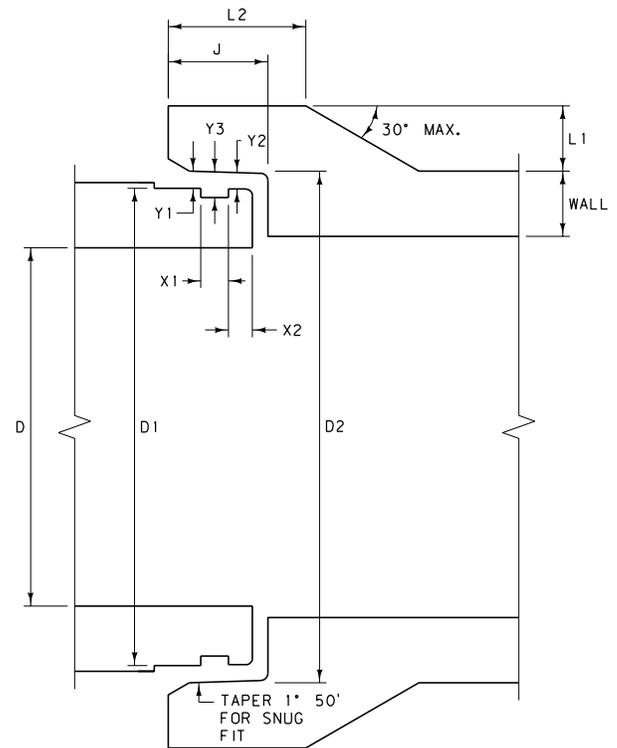
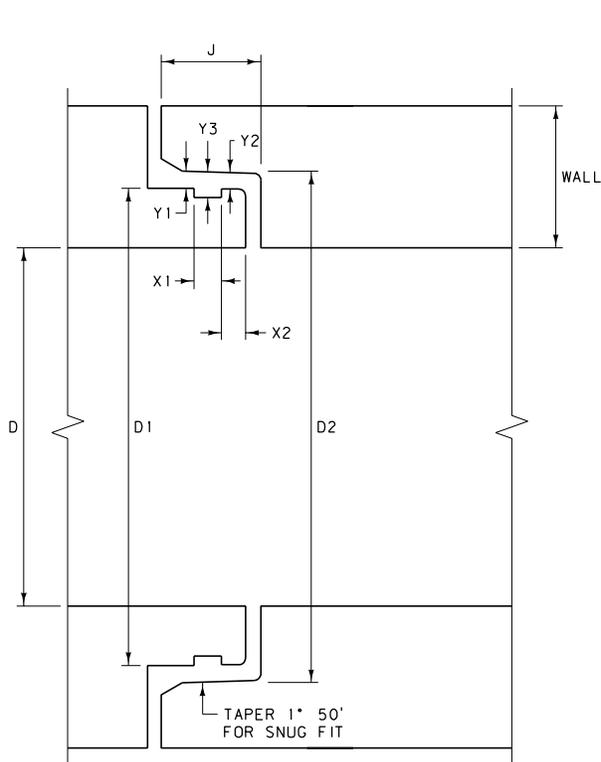
ALL FOUNDATIONS REQUIRE COMPACTION.

DETAILED DRAWING	
REFERENCE STANDARD SPEC.	DWG. NO. 603-20
SECTION 207, 603, 701	
RCP CULVERT BEDDING	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION <i>servicing you with pride</i>	

DIA. D	APPROX. DIA. GASKET MATL. NOT STRETCHED	LENGTH OF JOINT J	D1	D2	L2 (MIN. )	L1 (WALL "B" )	L1 (WALL "C" )	X1	X2	Y1	Y2	Y3
12"	2 <sup>1</sup> / <sub>32</sub> "	3 <sup>5</sup> / <sub>8</sub> "	15.223"	15.331"	5"	2"	~	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
15"	2 <sup>1</sup> / <sub>32</sub> "	3 <sup>5</sup> / <sub>8</sub> "	18.723"	18.831"	4 <sup>3</sup> / <sub>4</sub> "	2 <sup>3</sup> / <sub>16</sub> "	~	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
18"	2 <sup>1</sup> / <sub>32</sub> "	3 <sup>5</sup> / <sub>8</sub> "	22.098"	22.206"	5"	2 <sup>3</sup> / <sub>8</sub> "	~	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
21"	2 <sup>1</sup> / <sub>32</sub> "	3 <sup>7</sup> / <sub>8</sub> "	25.600"	25.724"	5 <sup>1</sup> / <sub>4</sub> "	2 <sup>9</sup> / <sub>16</sub> "	~	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
24"	2 <sup>1</sup> / <sub>32</sub> "	3 <sup>7</sup> / <sub>8</sub> "	28.975"	29.099"	5 <sup>1</sup> / <sub>2</sub> "	2 <sup>3</sup> / <sub>4</sub> "	2"	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
27"	2 <sup>1</sup> / <sub>32</sub> "	4"	32.476"	32.608"	5 <sup>1</sup> / <sub>2</sub> "	2 <sup>3</sup> / <sub>4</sub> "	2"	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
30"	2 <sup>1</sup> / <sub>32</sub> "	4"	35.976"	36.108"	5 <sup>1</sup> / <sub>2</sub> "	2 <sup>3</sup> / <sub>4</sub> "	2"	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
33"	2 <sup>1</sup> / <sub>32</sub> "	4 <sup>1</sup> / <sub>8</sub> "	39.476"	39.616"	5 <sup>3</sup> / <sub>4</sub> "	2 <sup>7</sup> / <sub>8</sub> "	2 <sup>1</sup> / <sub>8</sub> "	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
36"	2 <sup>1</sup> / <sub>32</sub> "	4 <sup>1</sup> / <sub>8</sub> "	42.976"	43.116"	6"	3 <sup>1</sup> / <sub>8</sub> "	2 <sup>3</sup> / <sub>8</sub> "	1"	7 <sup>8</sup> / <sub>8</sub> "	0.062"	0.090"	0.313"
42"	3 <sup>1</sup> / <sub>4</sub> "	4 <sup>5</sup> / <sub>8</sub> "	50.183"	50.183"	6 <sup>3</sup> / <sub>4</sub> "	3 <sup>3</sup> / <sub>4</sub> "	3"	1 <sup>3</sup> / <sub>16</sub> "	1"	0.067"	0.129"	0.376"
48"	3 <sup>1</sup> / <sub>4</sub> "	4 <sup>3</sup> / <sub>4</sub> "	57.023"	57.193"	7 <sup>1</sup> / <sub>4</sub> "	4 <sup>1</sup> / <sub>8</sub> "	3 <sup>3</sup> / <sub>8</sub> "	1 <sup>3</sup> / <sub>16</sub> "	1"	0.067"	0.129"	0.376"
54"	3 <sup>1</sup> / <sub>4</sub> "	5"	63.007"	63.192"	7 <sup>1</sup> / <sub>2</sub> "	3 <sup>5</sup> / <sub>8</sub> "	2 <sup>7</sup> / <sub>8</sub> "	1 <sup>3</sup> / <sub>16</sub> "	1"	0.067"	0.129"	0.376"
60"	3 <sup>1</sup> / <sub>4</sub> "	5"	69.007"	69.192"	7 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>8</sub> "	2 <sup>3</sup> / <sub>8</sub> "	1 <sup>3</sup> / <sub>16</sub> "	1"	0.067"	0.129"	0.376"
66"	1 <sup>3</sup> / <sub>16</sub> "	5"	75.007"	75.192"	7 <sup>1</sup> / <sub>2</sub> "	2 <sup>3</sup> / <sub>4</sub> "	2"	1 <sup>3</sup> / <sub>16</sub> "	1"	0.067"	0.129"	0.376"
72"	1 <sup>3</sup> / <sub>16</sub> "	5 <sup>1</sup> / <sub>4</sub> "	79.250"	79.400"	~	~	~	1 <sup>3</sup> / <sub>16</sub> "	1 <sup>1</sup> / <sub>4</sub> "	0.093"	0.190"	0.376"
78"	1 <sup>3</sup> / <sub>16</sub> "	5 <sup>1</sup> / <sub>4</sub> "	86.250"	86.400"	~	~	~	1 <sup>3</sup> / <sub>16</sub> "	1 <sup>1</sup> / <sub>4</sub> "	0.093"	0.190"	0.376"
84"	1 <sup>3</sup> / <sub>16</sub> "	5 <sup>1</sup> / <sub>4</sub> "	91.500"	91.650"	~	~	~	1 <sup>3</sup> / <sub>16</sub> "	1 <sup>1</sup> / <sub>4</sub> "	0.093"	0.190"	0.376"
90"	1 <sup>3</sup> / <sub>16</sub> "	5 <sup>1</sup> / <sub>4</sub> "	97.750"	97.900"	~	~	~	1 <sup>3</sup> / <sub>16</sub> "	1 <sup>1</sup> / <sub>4</sub> "	0.093"	0.190"	0.376"
96"	1 <sup>3</sup> / <sub>16</sub> "	5 <sup>1</sup> / <sub>4</sub> "	104.250"	104.400"	~	~	~	1 <sup>3</sup> / <sub>16</sub> "	1 <sup>1</sup> / <sub>4</sub> "	0.093"	0.190"	0.376"
102"	1 <sup>3</sup> / <sub>16</sub> "	5 <sup>1</sup> / <sub>4</sub> "	110.750"	110.900"	~	~	~	1 <sup>3</sup> / <sub>16</sub> "	1 <sup>1</sup> / <sub>4</sub> "	0.093"	0.190"	0.376"
108"	1 <sup>3</sup> / <sub>16</sub> "	5 <sup>1</sup> / <sub>4</sub> "	117.250"	117.400"	~	~	~	1 <sup>3</sup> / <sub>16</sub> "	1 <sup>1</sup> / <sub>4</sub> "	0.093"	0.190"	0.376"

72" DIA. PIPES AND LARGER

66" DIA. PIPES AND SMALLER



NOTES:

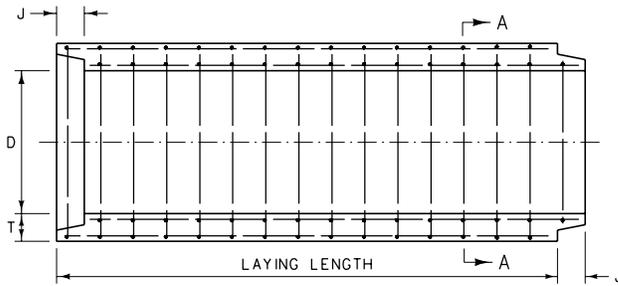
TYPICAL FOR STORM DRAIN AND IRRIGATION APPLICATIONS (FOR HEADS UP TO 20 FEET).

USE RUBBER GASKETS THAT MEET THE REQUIREMENTS OF STANDARD SPECIFICATION 707.02.1.

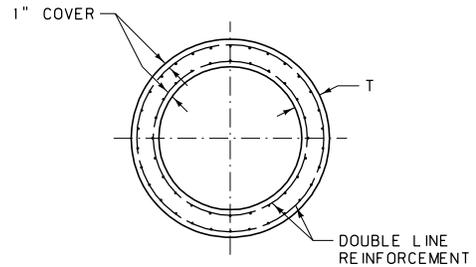
DETAILED DRAWING	
REFERENCE STANDARD SPEC. STANDARD 603, 707, 708	DWG. NO. 603-22
WATER TIGHT JOINT FOR REINFORCED CONCRETE PIPE	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION <i>servicing you with pride</i>	

DIA. D	XSEC. WATER AREA (SQ. FT.)	WT. PER L. F. OF PIPE (LB.)	T * MIN. WALL THICKNESS	J LENGTH OF JOINT	A (NOMINAL) = $\frac{D2 - D1}{2}$	D1	D2	D3	D4
12"	0.79	92	2"	1 3/4"	3/16"	13 1/4"	13 5/8"	13 7/8"	14 1/4"
15"	1.23	127	2 1/4"	2"	3/16"	16 1/2"	16 7/8"	17 1/4"	17 5/8"
18"	1.77	168	2 1/2"	2 1/4"	3/16"	19 5/8"	20"	20 3/8"	20 3/4"
21"	2.40	214	2 3/4"	2 1/2"	3/16"	22 7/8"	23 1/4"	23 3/4"	24 1/8"
24"	3.14	265	3"	2 3/4"	3/16"	26"	26 3/8"	27"	27 3/8"
27"	3.98	322	3 1/4"	3"	3/16"	29 1/4"	29 5/8"	30 1/4"	30 5/8"
30"	4.91	384	3 1/2"	3 1/4"	3/16"	32 3/8"	32 3/4"	33 1/2"	33 3/8"
33"	5.94	452	3 3/4"	3 1/2"	1/4"	35 1/2"	36"	36 3/4"	37 1/4"
36"	7.07	524	4"	3 3/4"	1/4"	38 3/4"	39 1/4"	40"	40 1/2"
42"	9.62	685	4 1/2"	4"	1/4"	45 1/8"	45 3/8"	46 1/2"	47"
48"	12.57	867	5"	4 1/4"	1/4"	51 1/2"	52"	53"	53 1/2"
54"	15.90	1070	5 1/2"	4 1/2"	1/4"	57 7/8"	58 3/8"	59 3/8"	59 7/8"
60"	19.63	1296	6"	5"	1/4"	64 1/4"	64 3/4"	66"	66 1/2"
66"	23.76	1542	6 1/2"	5 1/2"	1/4"	70 5/8"	71 1/8"	72 1/2"	73"
72"	28.27	1810	7"	6"	1/4"	77"	77 1/2"	79"	79 1/2"
78"	33.18	2098	7 1/2"	6 1/2"	1/4"	83 3/8"	83 3/8"	85 5/8"	86 1/3"
84"	38.48	2410	8"	7"	1/4"	89 3/4"	90 1/4"	92 1/8"	92 5/8"
90"	44.18	2740	8 1/2"	7"	1/4"	95 3/4"	96 1/4"	98 1/8"	98 5/8"
96"	50.27	2950	9"	7"	1/4"	102 1/8"	102 5/8"	104 1/2"	105"
102"	56.75	3075	9 1/2"	7 1/2"	1/4"	109"	109 1/2"	111 1/2"	112"
108"	63.62	3870	10"	7 1/2"	1/4"	115 1/2"	116"	118"	118 1/2"

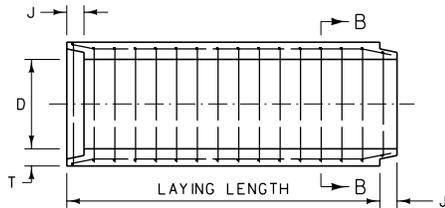
\* WALL "B" THICKNESS



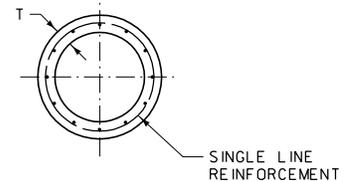
TYPICAL LONGITUDINAL SECTION  
36" DIAMETER PIPES AND LARGER



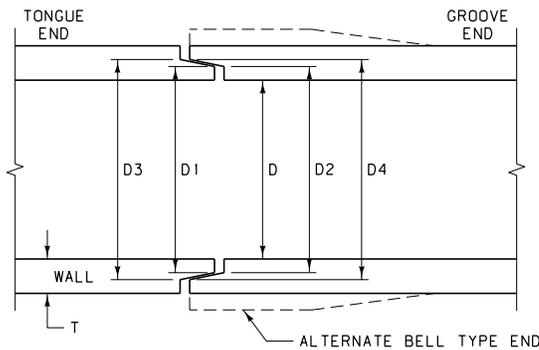
SECTION A-A



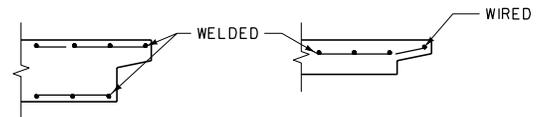
TYPICAL LONGITUDINAL SECTION  
33" DIAMETER PIPES AND SMALLER



SECTION B-B



JOINT DETAIL



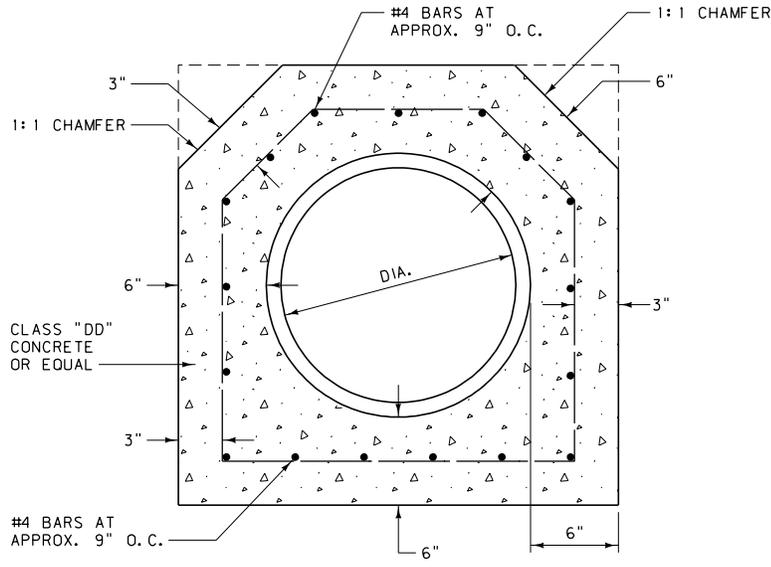
REINFORCING AT ENDS OF PIPE

NOTES:

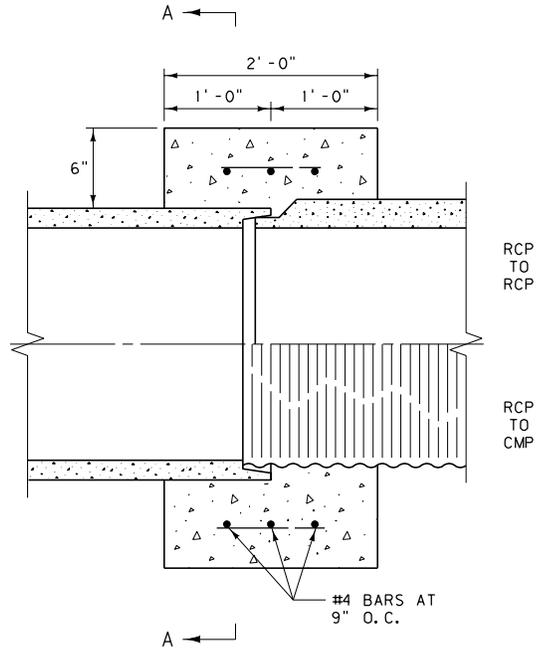
TOLERANCES IN DIMENSIONS IN ACCORDANCE WITH AASHTO M 170.

TYPICAL FOR DRAINAGE APPLICATIONS.

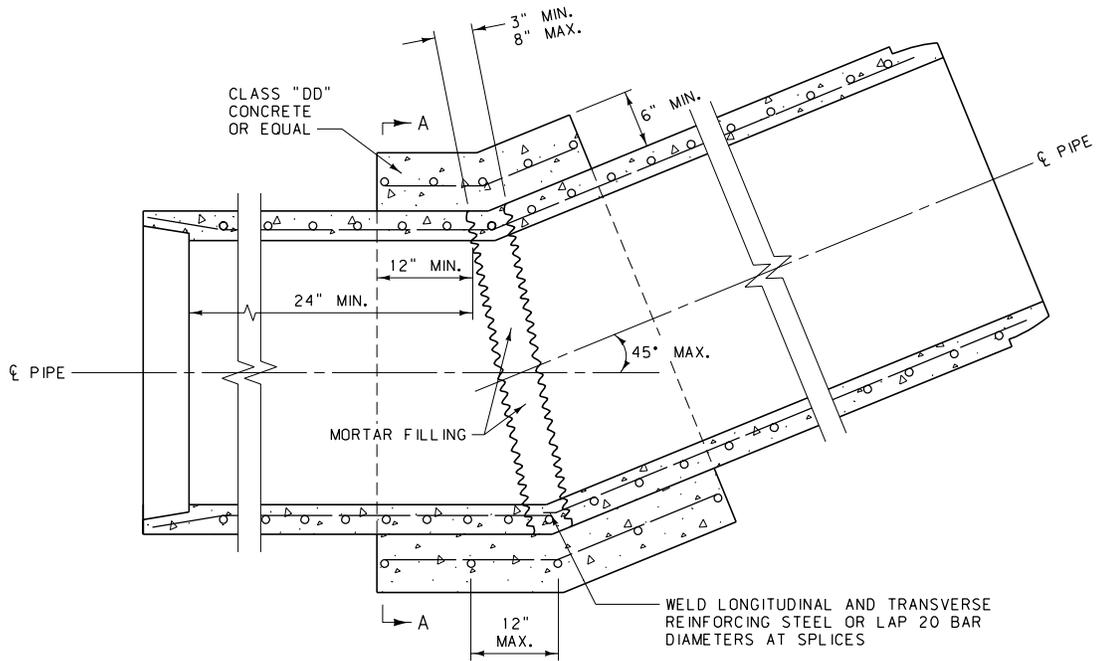
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603, 708	DWG. NO. 603-24
REINFORCED CONCRETE PIPE JOINT	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION <i>servicing you with pride</i>	



SECTION A-A



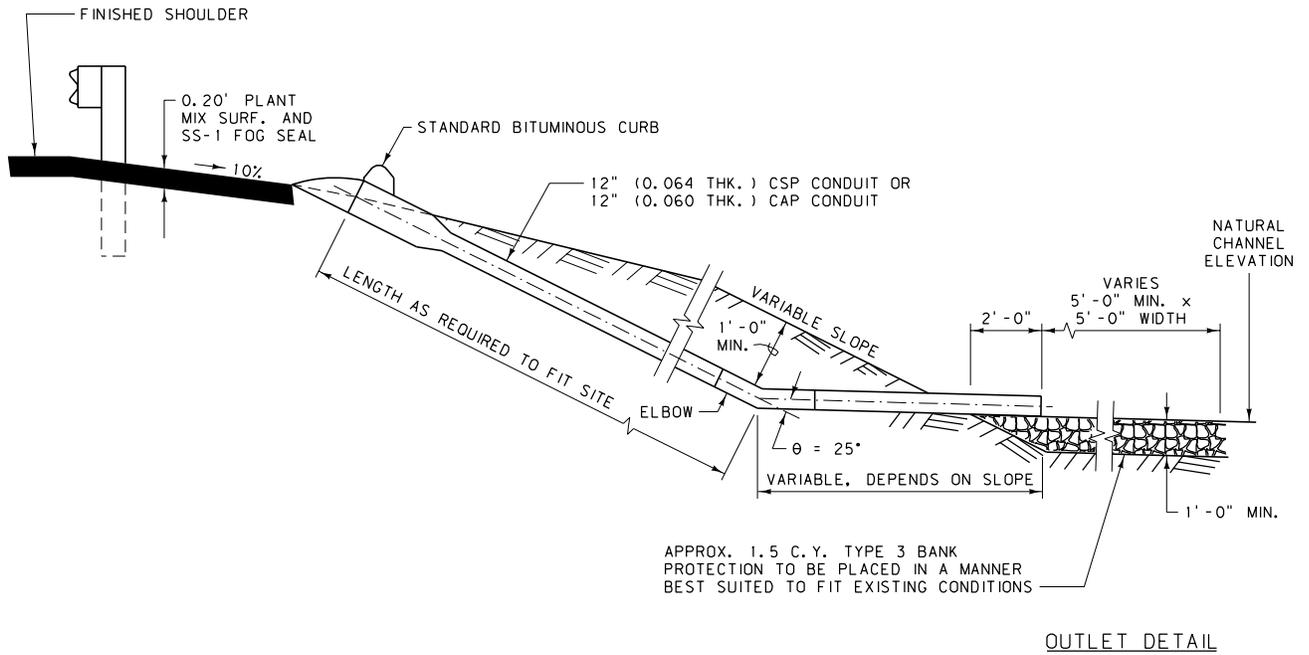
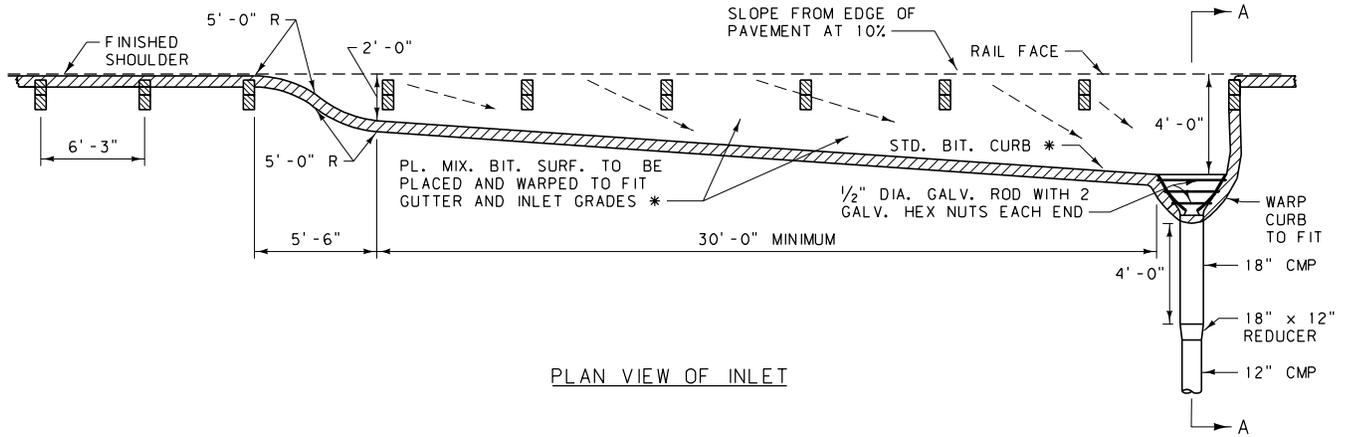
CONNECTION DETAILS



TYPICAL FIELD CAST CONCRETE BEND

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603, 708	DWG. NO. 603-26
TYPICAL FIELD CAST CONCRETE CONNECTIONS	
EFFECTIVE: FEBRUARY 2005	
 <b>MONTANA DEPARTMENT OF TRANSPORTATION</b> <i>servicing you with pride</i>	

NOTE: DASHED ARROWS DENOTE DIRECTION OF WATER FLOW.



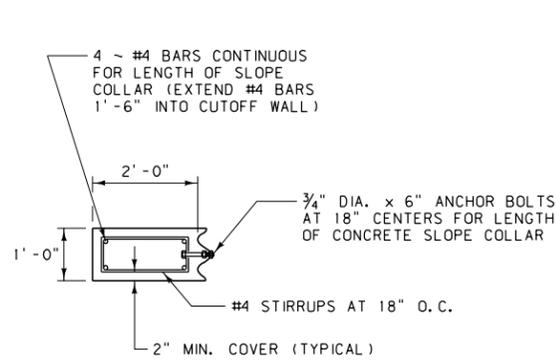
SECTION A-A

NOTES:

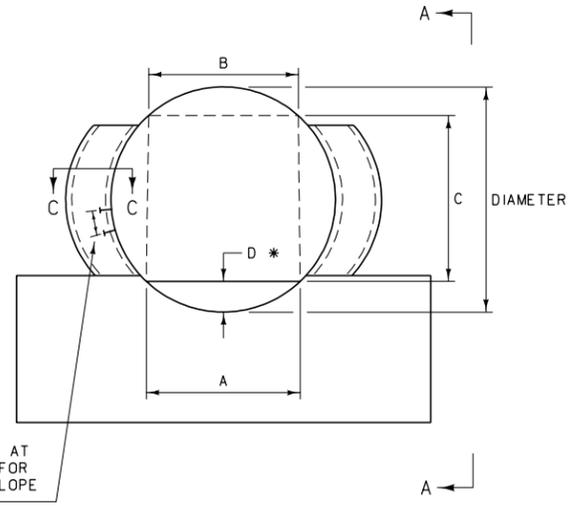
CORRUGATION MAY BE EITHER ANNULAR OR HELICAL. BEND ON ELBOW ( $\theta$ ) IS AS SHOWN UNLESS OTHERWISE SPECIFIED IN THE PLANS OR BY THE ENGINEER.

\* INCLUDED WITH ROADWAY QUANTITIES.

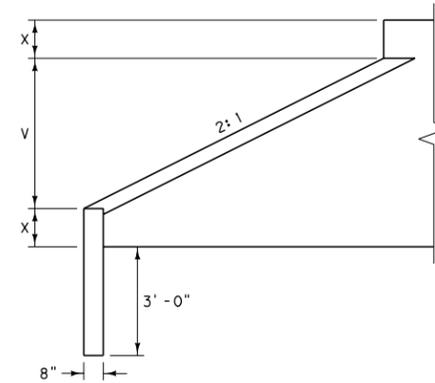
DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603	DWG. NO. 603-28
EMBANKMENT PROTECTOR	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION <i>-serving you with pride</i>	



NOTE:  
SEE DTL. DWG. NO. 552-00  
FOR ANCHOR BOLT DETAILS.



ELEVATION



SECTION A-A

NOTES:

DESIGNATE THESE STRUCTURES, IN PLANS AND PROPOSAL, AS "VEHICULAR UNDERPASS." CONFORM MATERIALS, INSTALLATION, AND OTHER PROVISIONS TO THE STANDARD SPECIFICATIONS. USE THE TERM "VEHICULAR UNDERPASS," REGARDLESS OF THE USE OR PURPOSE OF THE STRUCTURE.

PROVIDE END TREATMENT FOR ALL VEHICULAR UNDERPASSES INCLUDING CUTOFF WALLS, BACKFILL RETAINING WALLS AND CONCRETE SLOPE COLLARS.

PROVIDE SURFACING FOR THE INSIDE OF THE STRUCTURE, CROSS-SLOPED TO ALLOW A DRAINAGE COURSE ALONG ONE SIDE.

FOR PLATE THICKNESS SEE ROAD DESIGN MANUAL FILL HEIGHT TABLES.

USE CLASS "DD" CONCRETE OR EQUAL.

SEE DTL. DWG. NO. 552-08 FOR QUANTITIES.

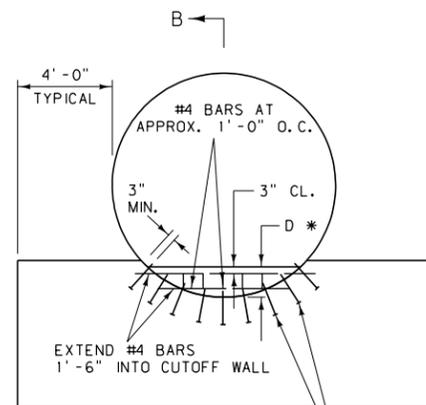
SECTION C-C

DEPTH OF SURFACING *		
MATERIAL	ALTERNATE "A"	ALTERNATE "B"
PL. MIX SURF.	—	0.20'
CR. TOP SURF.	0.20'	0.20'
CR. BASE OR SELECT SURF.	BAL.	BAL.

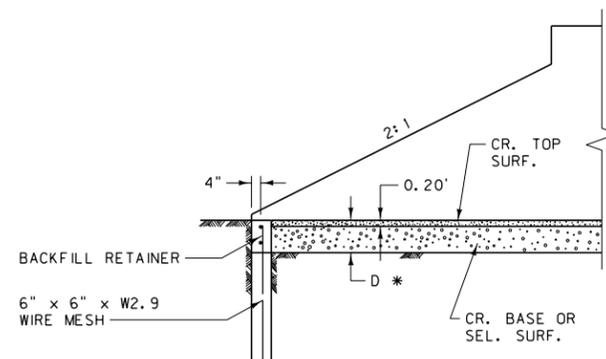
DIAMETER	A	B	C	V	X	* D	BACKFILL RETAINER (C. Y. )	CONCRETE COLLAR (C. Y. )
96"	4'	4'	6.9'	4.0'	2.0'	0.5'	0.04	0.66
120"	7'	7'	7.1'	5.0'	2.5'	1.4'	0.17	0.82
150"	10'	8'	8.6'	6.25'	3.13'	2.5'	0.43	1.08
162"	10'	8'	10.0'	6.75'	3.38'	2.2'	0.38	1.16
186"	12'	10'	10.8'	7.75'	3.88'	2.9'	0.59	1.34
192"	12'	10'	11.5'	8.0'	4.0'	2.7'	0.55	1.38
204"	12'	10'	12.9'	8.5'	4.25'	2.5'	0.51	1.46
216"	12'	10'	14.2'	9.0'	4.50'	2.3'	0.47	1.54
228"	16'	12'	12.5'	9.5'	4.75'	4.4'	1.23	1.72
240"	16'	12'	14.0'	10.0'	5.0'	4.0'	1.10	1.72

DIAMETER	SURFACING QUANTITIES PER LINEAR FOOT FOR DEPTH "D" *								
	ALTERNATE "A"		ALTERNATE "B"						
	C. Y. SURFACING		TONS SURFACING		C. Y. SURFACING		TONS BIT. MATL.		
	CRUSHED TOP SURF.	CR. BASE OR SEL. SURF.	COVER MATERIAL	PLANT MIX	CRUSHED TOP SURF.	CR. BASE OR SEL. SURF.	PLANT MIX	PRIME	SEAL
96"	0.027	0.027	0.0056	0.052	0.020	0.007	0.0031	0.0005	0.0007
120"	0.050	0.205	0.0097	0.097	0.047	0.158	0.0058	0.0009	0.0012
150"	0.073	0.574	0.0139	0.141	0.070	0.504	0.0084	0.0014	0.0017
162"	0.073	0.490	0.0139	0.140	0.069	0.420	0.0084	0.0014	0.0017
186"	0.088	0.794	0.0167	0.169	0.085	0.709	0.0102	0.0017	0.0020
192"	0.087	0.743	0.0167	0.168	0.085	0.659	0.0101	0.0016	0.0020
204"	0.088	0.681	0.0167	0.169	0.084	0.596	0.0102	0.0016	0.0020
216"	0.087	0.615	0.0167	0.168	0.084	0.531	0.0101	0.0016	0.0020
228"	0.118	1.724	0.0222	0.227	0.116	1.609	0.0136	0.0022	0.0026
240"	0.117	1.539	0.0222	0.226	0.115	1.424	0.0136	0.0022	0.0026

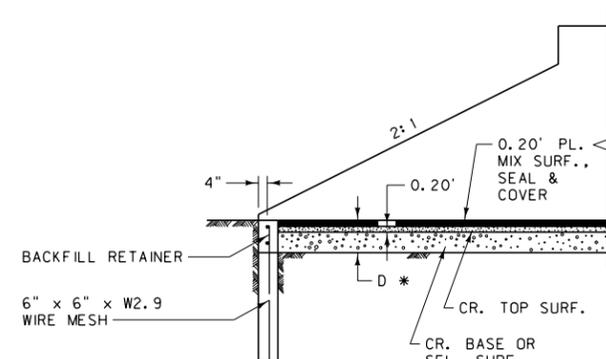
BACKFILL RETAINER & CUTOFF WALL DETAIL



ELEVATION



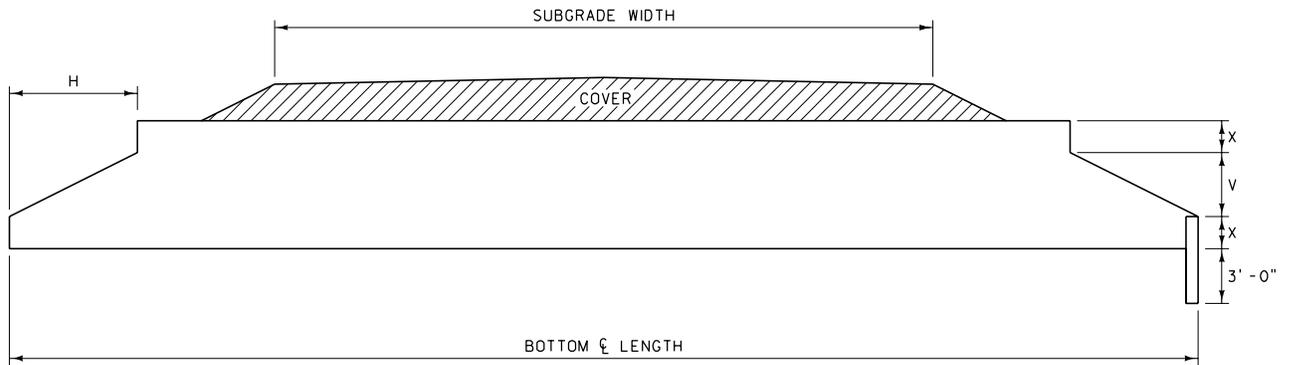
SECTION B-B  
(ALTERNATE "A")



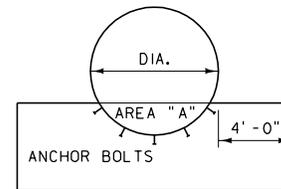
SECTION B-B  
(ALTERNATE "B")

NOTE:  
INCLUDE CONCRETE COLLAR  
WHEN SPECIFIED.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 552, 603	DWG. NO. 603-30
VEHICULAR UNDERPASS AND BACKFILL RETAINER & CUTOFF WALL DETAIL	
EFFECTIVE: FEBRUARY 2005	
 serving you with pride	MONTANA DEPARTMENT OF TRANSPORTATION



NOTE:  
FOR DETAILS COVERING CUTOFF WALLS  
SEE DTL. DWG. NO. 552-00.

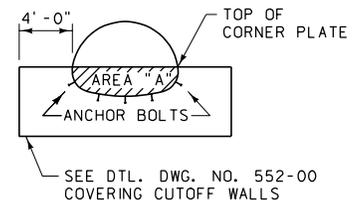
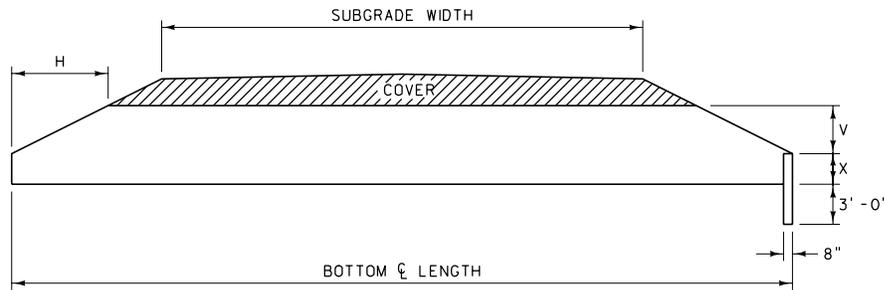


DIA.	X (FT.)	V (FT.)	H (FT.) FOR BEVELS:		AREA "A" (SQ. FT.) *
			1.5:1	2:1	
CSP 3" x 1" OR 5" x 1" CORRUGATIONS					
48"	1.000	2.000	3.000	4.000	2.63
54"	1.125	2.250	3.375	4.500	3.31
60"	1.250	2.500	3.750	5.000	4.06
66"	1.375	2.750	4.125	5.500	4.89
72"	1.500	3.000	4.500	6.000	5.79
78"	1.625	3.250	4.875	6.500	6.77
84"	1.750	3.500	5.250	7.000	7.83
90"	1.875	3.750	5.625	7.500	8.97
96"	2.000	4.000	6.000	8.000	10.18
102"	2.125	4.250	6.375	8.500	11.47
108"	2.250	4.500	6.750	9.000	12.83
114"	2.375	4.750	7.125	9.500	14.27
120"	2.500	5.000	7.500	10.000	15.79

DIA.	X (FT.)	V (FT.)	H (FT.) FOR BEVELS:		AREA "A" (SQ. FT.) *
			1.5:1	2:1	
SSPP 6" x 2" CORRUGATIONS					
126"	2.625	5.250	7.875	10.500	17.39
132"	2.750	5.500	8.250	11.000	19.06
138"	2.875	5.750	8.625	11.500	20.81
144"	3.000	6.000	9.000	12.000	22.64
150"	3.125	6.250	9.375	12.500	24.54
156"	3.250	6.500	9.750	13.000	26.52
162"	3.375	6.750	10.125	13.500	28.58
168"	3.500	7.000	10.500	14.000	30.71
174"	3.625	7.250	10.875	14.500	32.92
180"	3.750	7.500	11.250	15.000	35.21
186"	3.875	7.750	11.625	15.500	37.57
192"	4.000	8.000	12.000	16.000	40.01
198"	4.125	8.250	12.375	16.500	42.53
204"	4.250	8.500	12.750	17.000	45.12
210"	4.375	8.750	13.125	17.500	47.79
216"	4.500	9.000	13.500	18.000	50.54
228"	4.750	9.500	14.250	19.000	56.26
240"	5.000	10.000	15.000	20.000	62.29
252"	5.250	10.500	15.750	21.000	68.63

\* AREA "A" IS TO THE MIDDLE OF THE CORRUGATIONS.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603	DWG. NO. 603-32
STEP BEVEL FOR CIRCULAR METAL CULVERT	
EFFECTIVE: FEBRUARY 2005	
 <b>MONTANA DEPARTMENT OF TRANSPORTATION</b> <i>servicing you with pride</i>	



SPAN	RISE	EQUIV. DIA.	X (FT.)	V (FT.)	H (FT.) FOR BEVELS:			AREA "A" (SQ. FT.)
					1.5:1	2:1	2.5:1	
SSPPA 6" x 2" CORRUGATIONS WITH 18" CORNER RADIUS								
6'-1"	4'-7"	66"	2.3	2.3	3.4	4.6	5.7	12.8
6'-9"	4'-11"	72"	2.4	2.5	3.8	5.0	6.3	14.8
7'-3"	5'-3"	78"	2.1	3.2	4.7	6.3	7.9	14.1
7'-11"	5'-7"	84"	2.3	3.3	4.9	6.6	8.2	16.8
8'-7"	5'-11"	90"	2.3	3.6	5.4	7.2	9.0	18.0
9'-4"	6'-3"	96"	2.5	3.8	5.6	7.5	9.4	21.0
9'-9"	6'-7"	102"	2.2	4.4	6.6	8.8	11.0	19.8
10'-8"	6'-11"	108"	2.8	4.1	6.2	8.2	10.3	26.6
11'-5"	7'-3"	114"	2.8	4.5	6.7	8.9	11.1	27.9
11'-10"	7'-7"	120"	2.5	5.1	7.6	10.2	13.6	26.4
12'-6"	7'-11"	126"	2.7	5.2	7.8	10.4	13.0	30.0
12'-10"	8'-4"	132"	2.3	6.0	8.9	11.9	14.9	26.9
SSPPA 6" x 2" CORRUGATIONS WITH 31" CORNER RADIUS								
13'-3"	9'-4"	~	3.9	5.5	8.2	10.9	13.6	45.7
13'-6"	9'-6"	~	3.8	5.7	8.6	11.5	14.3	45.7
14'-0"	9'-8"	144"	4.0	5.7	8.5	11.4	14.2	49.1
14'-3"	9'-10"	~	3.8	6.1	9.1	12.1	15.2	47.6
14'-5"	10'-0"	~	3.7	6.3	9.5	12.7	15.9	47.4
14'-11"	10'-2"	~	4.0	6.2	9.3	12.4	15.5	52.4
15'-4"	10'-4"	156"	4.3	6.0	9.1	12.1	15.1	57.6
15'-7"	10'-6"	~	4.1	6.4	9.6	12.8	16.1	55.9
15'-10"	10'-8"	~	3.9	6.8	10.2	13.6	17.0	54.2
16'-3"	10'-10"	~	4.3	6.5	9.8	13.1	16.4	61.1
16'-6"	11'-0"	168"	4.1	6.9	10.4	13.9	17.3	59.4
17'-0"	11'-2"	~	4.4	6.8	10.2	13.6	17.0	64.7
17'-2"	11'-4"	~	4.3	7.1	10.6	14.1	17.6	64.6
17'-5"	11'-6"	~	4.1	7.4	11.2	14.9	18.6	62.6
17'-11"	11'-8"	180"	4.3	7.4	11.1	14.8	18.5	66.6
18'-1"	11'-10"	~	4.2	7.7	11.5	15.3	19.2	66.4
18'-7"	12'-0"	~	4.5	7.5	11.3	15.0	18.8	72.2
18'-9"	12'-2"	~	4.3	7.9	11.8	15.8	19.7	70.1
19'-3"	12'-4"	192"	4.6	7.7	11.6	15.5	19.4	76.3
19'-6"	12'-6"	~	4.4	8.1	12.2	16.3	20.3	74.1
19'-8"	12'-8"	~	4.3	8.4	12.6	16.8	21.0	73.7
19'-11"	12'-10"	~	4.1	8.8	13.2	17.6	22.0	71.3
20'-5"	13'-0"	204"	4.4	8.6	12.9	17.3	21.6	77.6
20'-7"	13'-2"	~	4.3	8.9	13.4	17.8	22.3	77.2

SPAN	RISE	EQUIV. DIA.	X (FT.)	V (FT.)	H (FT.) FOR BEVELS:			AREA "A" (SQ. FT.)
					1.5:1	2:1	2.5:1	
CSPA 3" x 1" CORRUGATIONS (SEE NOTE ⓧ)								
60"	46"	54"	1.7	2.3	3.5	4.7	5.8	7.1
66"	51"	60"	1.9	2.6	3.9	5.2	6.5	8.7
73"	55"	66"	2.1	2.8	4.1	5.5	6.9	10.7
81"	59"	72"	2.0	3.2	4.8	6.5	8.1	11.1
87"	63"	78"	2.1	3.5	5.2	6.9	8.6	13.2
95"	67"	84"	2.3	3.7	5.5	7.3	9.2	15.3
103"	71"	90"	2.5	3.9	5.8	7.7	9.6	17.8
112"	75"	96"	2.6	4.1	6.1	8.1	10.2	20.2
117"	79"	102"	2.8	4.3	6.4	8.5	10.7	23.1
128"	83"	108"	3.0	4.5	6.7	8.9	11.2	25.9
137"	87"	114"	3.1	4.7	7.0	9.4	11.7	29.0
142"	91"	120"	3.3	4.9	7.3	9.7	12.2	32.2
CSPA 2 2/3" x 1/2" CORRUGATIONS (SEE NOTE ⓧ)								
57"	38"	48"	1.1	2.1	3.1	4.2	5.2	4.5
64"	43"	54"	1.2	2.4	3.5	4.7	5.9	5.6
71"	47"	60"	1.4	2.6	3.8	5.1	6.4	6.9
77"	52"	66"	1.5	2.8	4.3	5.7	7.1	8.2
83"	57"	72"	1.6	3.1	4.7	6.3	7.8	9.6

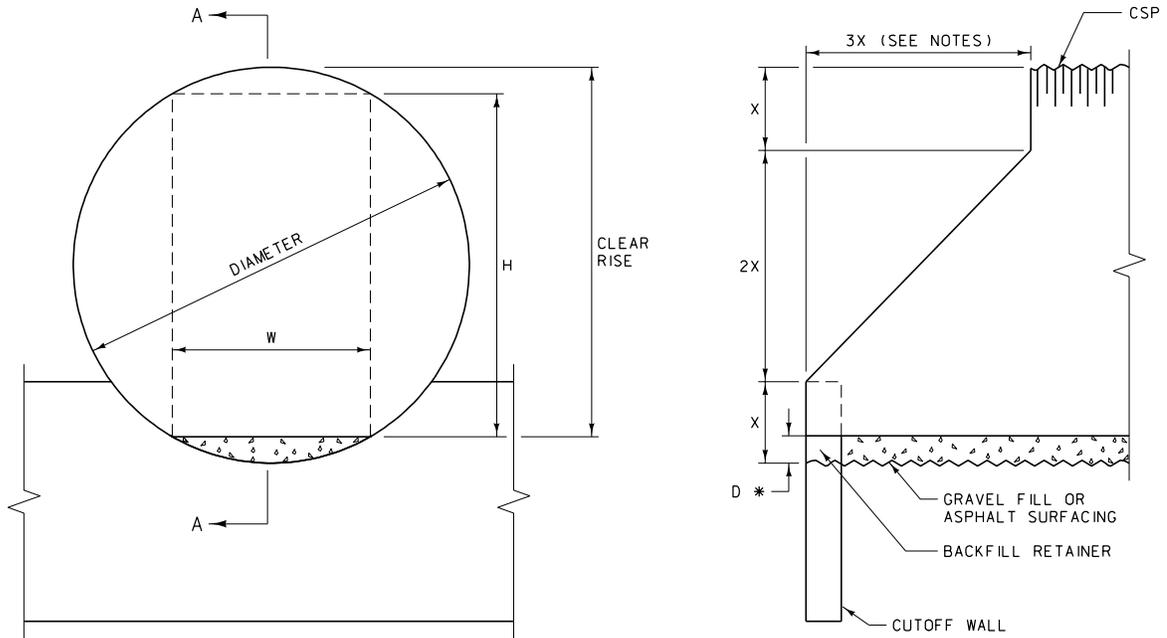
NOTES:

BEVEL TO TOP OF CORNER PLATE.

PIPE ENDS ARE SQUARE (PERPENDICULAR TO CENTERLINE OF PIPE) AND FILL SLOPES ARE WARPED TO ACCOMMODATE THE SQUARE ENDS UNLESS SPECIFIED OTHERWISE ON PLANS.

ⓧ TABULATED VALUES BASED ON NOMINAL PIPE DIMENSIONS. IN PLACE DIMENSIONS SUBJECT TO TOLERANCES LISTED IN CURRENT AASHTO M 36 AND M 196.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603	DWG. NO. 603-34
BEVEL ON ARCH METAL CULVERT	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION <i>servicing you with pride</i>	



SECTION A-A

DIAMETER	X	* D	CLEAR RISE	H	W	BACKFILL RETAINER (CUBIC YARDS)
84"	21.0"	0.50'	6.5'	6.0'	3.6'	0.1
90"	22.5"	0.75'	6.75'	6.0'	4.5'	0.1
96"	24.0"	0.83'	7.17'	6.34'	4.9'	0.1

DIAMETER	SURFACING QUANTITIES PER LINEAR FOOT FOR DEPTH "D" *				
	FULL DEPTH GRAVEL		0.20' PMS AND REMAINING DEPTH GRAVEL		
	C. Y. SURF.	TONS SURF.	C. Y. SURF.	TONS BIT. MATERIAL	
	CR. TOP SURF.	PLANT MIX	CR. TOP SURF.	PLANT MIX	PRIME
84"	0.045	0.046	0.021	0.0028	0.0004
90"	0.085	0.060	0.054	0.0036	0.0006
96"	0.102	0.066	0.068	0.0040	0.0006

NOTES:

UNLESS OTHERWISE SPECIFIED, INSTALL STOCKPASSES WITH CUTOFF WALLS AND BACKFILL RETAINERS AT EACH END, GRAVEL FILL AND BEDDING MATERIAL.

WHEN SPECIFIED, INSTALL COMBINATION STOCKPASSES AND DRAINS WITH CUTOFF WALLS, BACKFILL RETAINERS AT BOTH ENDS, CONCRETE EDGE PROTECTION AT THE INLET END, RANDOM RIPRAP AT THE OUTLET END, BEDDING MATERIAL AND ASPHALT SURFACING; CROSS SLOPE ASPHALT SURFACING TO ALLOW DRAINAGE COURSE ALONG ONE SIDE. (SEE DTL. DWG. NO. 613-14 AND 613-06.)

UNLESS OTHERWISE SPECIFIED, STEP BEVEL PIPE ENDS AT A 1.5:1 SLOPE.

THE MINIMUM THICKNESS FOR CORRUGATED STEEL PIPE STOCKPASS IS 0.079". (SEE FILL HEIGHT TABLES FOR OTHER THAN THE MINIMUM REQUIREMENTS.)

SEE DTL. DWG. NO. 552-00, 603-30 AND 603-18.

DETAILED DRAWING	
REFERENCE STANDARD SPEC. SECTION 603	DWG. NO. 603-36
CORRUGATED STEEL PIPE STOCKPASS	
EFFECTIVE: FEBRUARY 2005	
 MONTANA DEPARTMENT OF TRANSPORTATION <i>servicing you with pride</i>	